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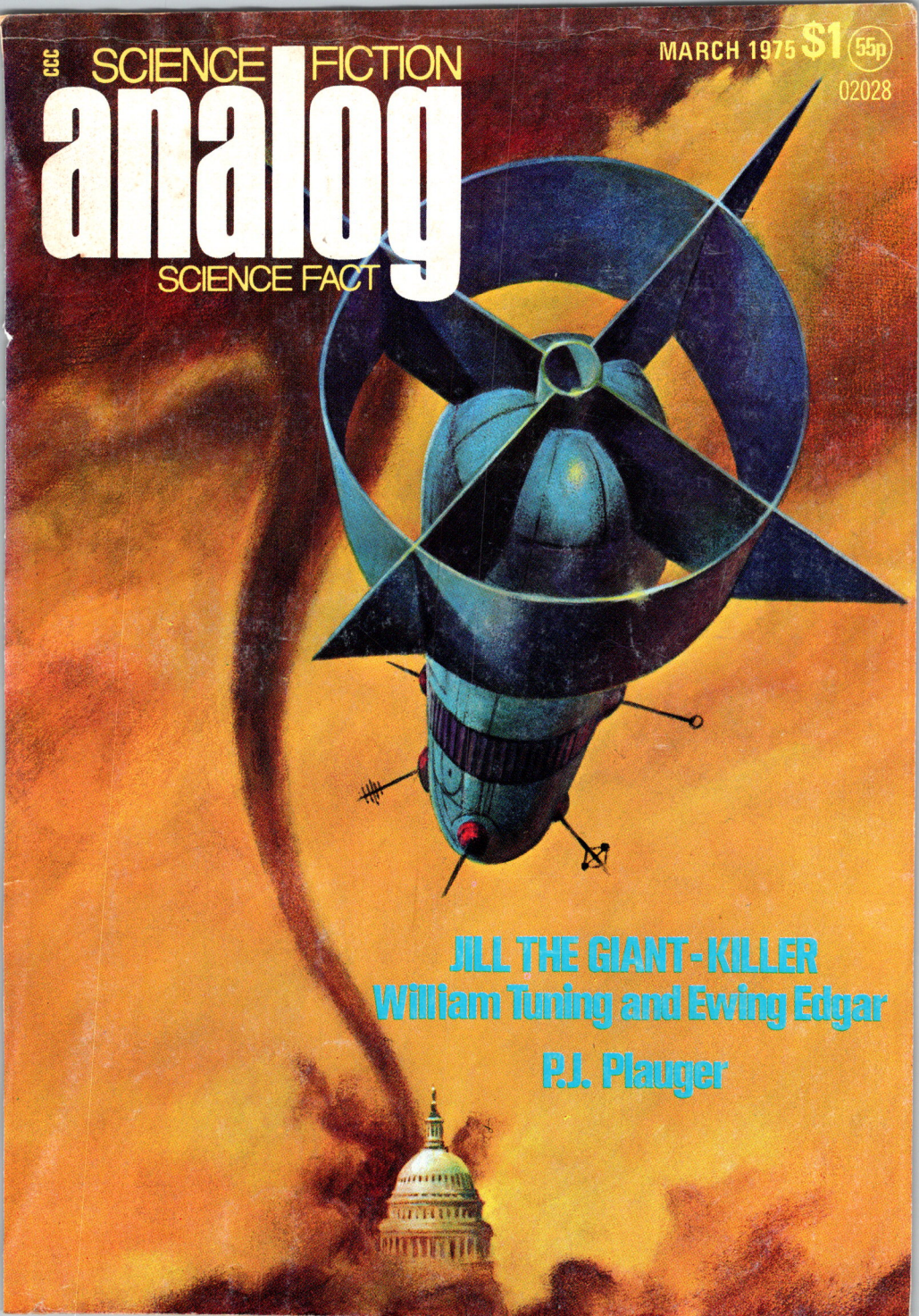

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A Calendar of Upcoming Events

February 28-March 2, 1975:
BOSKONE 12 (New England Regional SF Conference) at Sheraton-Boston Hotel, Boston, Massachusetts. Guest of Honor, Anne McCaffrey. Registration: $4 until February 1, $6 thereafter. Info: NESFA, Box G, MIT Branch PO, Cambridge, Massachusetts 02139.

March 14-March 16, 1975:
LEPRECON (Phoenix Area SF Conference) at Quality Inn, Phoenix, Arizona. Guest of Honor, Larry Niven. Registration: $4 until March 1, $5 thereafter. Info: Tim Kyger, 702 East Vista del Cerro, Tempe, Arizona 85281.

March 21-March 23, 1975:
MARCON 10 (Ohio Regional SF Conference) at Neil House Motor Hotel, Columbus, Ohio. Guest of Honor, James Gunn. Info: Larry or Cele Smith, 194 East Tulane Road, Columbus, Ohio 43202.

March 21-March 24, 1975:
APECON 2 (Planet of the Apes Fan Conference). Registration: $10 attending ($3 for one day), $3 supporting. Info: Jules Verne Society, Box 4156, Panorama City, California 91412.

March 28-March 31, 1975:
SEACON 75 (British National SF Convention) at DeVere Hotel, Coventry. Guest of Honor, Michael Moorcock. Registration: £2.50. Info: Malcolm Edwards, 19 Ranmoor Gardens, Harrow, Middlesex HA1 1UQ, England.

August 14-August 17, 1975:
AUSSIECON 75 (33rd World Science Fiction Convention) at Southern Cross Hotel, Melbourne, Australia. Guest of Honor, Ursula K. LeGuin. Fan Guests of Honor, Mike Glicksohn and Susan Wood. Info: Box 4039, Melbourne 3001 Australia. US Agents: Jack Chalker, 5111 Liberty Heights Avenue, Baltimore, Maryland 21207, or Fred Patten, 11863 W. Jefferson Boulevard, #1, Culver City, California 90230. Canadian Agent: John Millard, 86 Broadway Avenue, Apt. 18, Toronto M4P 1T4 Ontario. Registration: $12 attending, $4 supporting.

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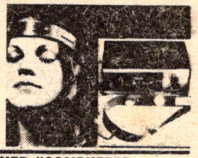

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EDITORIAL

the wrath of the people

The average American seems to picture himself as the classic Western hero portrayed by John Wayne: slow to anger, but mighty in his righteous wrath.

That's how most journalists and broadcasters analyzed last November's national elections. The voters had risen in their rightful dudgeon against the skulduggery of Watergate and the skyrocketing prices of double-digit inflation.

Unfortunately, most Americans think that once the shootout (or election campaign) is over, their problem is solved. They go home after casting their ballots and return to passively watching a new set of politicians wrestle with the same old problems, just as ineffectively as the old set, for the most part. It's as if John Wayne shot down the bankrobbers and walked back to the jailhouse to take a nap, while a new set of bankrobbers rode into town and cheerfully cleaned out the vault.

The simple truth is that most people are incredibly passive, and quite willing to be led around by the nose by activists of doubtful virtue, toward goals that serve the interests of the leaders, perhaps, but certainly not the led.

This cow-like (I hesitate to say bovine) passivity became excruciatingly clear to me in Newark, New Jersey, of all places.

The Cunard Line arranged a Science Fiction Cruise last autumn. Gordon Dickson, Frederik Pohl, Sonya Dorman, Kelly Freas and your friendly Editor were invited aboard the Cunard *Adventurer* to give lectures about the world of the future to the paying passengers—who, incidentally, were not (repeat *not*) science fiction fans or readers. The ship started the week-long cruise in San Juan; passengers from New York took a charter flight operated by Overseas National Airways (ONA), which was to leave from JFK Airport.

Except that when we got to JFK early that morning, we were cheerfully informed that ONA didn't have a plane there for us. We were bundled into busses and driven over to the Newark Airport. Many

of the passengers had just come from New Jersey, at considerable taxi or bus fare. But, back to Jersey we went.

There was a plane at Newark, all right, but it was in no condition to take off. We were herded into the old, abandoned North Terminal and left to wait for several hours while "They" worked on the plane. There was no food in the terminal building; the restaurant had long been closed. Taxis would take customers to the new terminal building, a five-minute drive, for five dollars a head.

So for more than three hours, more than a hundred people sat around and waited, swaddled in their coats and tripping over their luggage, without food, without coffee, without definite word on when—if ever—the plane would be ready to take off. Was there righteous wrath? Hardly. Most of the passengers told each other, "They're doing the best they can," and accepted the general notion that charter airlines have no real obligation to do anything for their customers. Instead of spending the day in San Juan, vacationing in the sun, they were sitting, cold and hungry, in an abandoned Newark airport terminal—and blandly accepting it as one of life's little inconveniences.

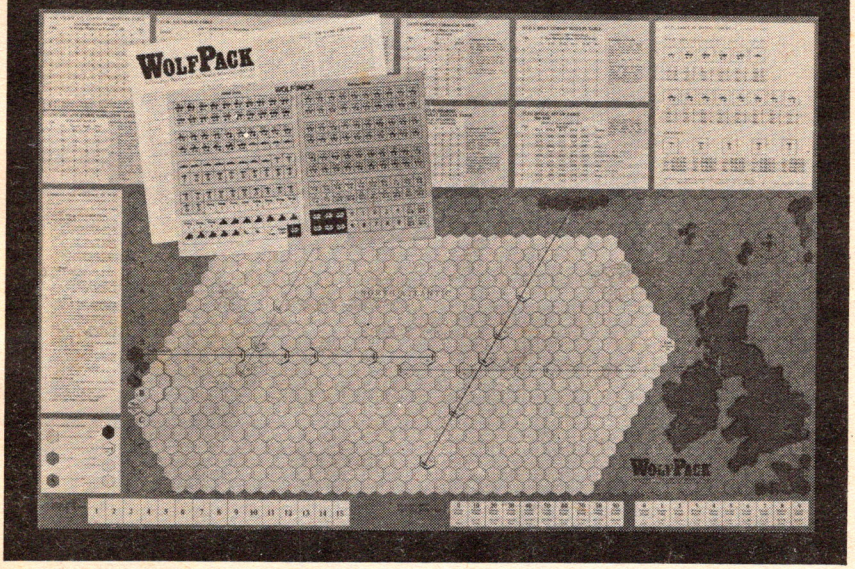
ONA pulled exactly the same deal on the return flight, one week later. Another multi-hour delay, this time in the teeming rain of a Puerto Rican autumn storm. The blasé ONA people at the airport simply shrugged it all off. "Happens all the time," they said. "The plane's never on time."

"And why is it never on time?" I asked myself. Because these self-styled John Waynes allow cheapjack outfits like ONA to get away with shoddy performance; they accept excuses instead of service; they seem to feel it would be embarrassing to demand what they paid for.

(Editor's Note: If any readers are planning to go to Melbourne for the 33rd World Science Fiction Convention by charter airline—be warned! Get guarantees in writing, with penalties for faulty service, if you don't want to spend a significant part of your trip in a makeshift cattle pen.)

The wrath of the people was also noticeably absent when the leader of the Palestine Liberation Organization, Yasser Arafat, visited the US to address the United Nations. Oh, a few New York Jews got upset and demonstrated against this terrorist. Members of the Jewish Defense League swore publicly to assassinate him, thereby proving to the average American that they're no brainier than Arafat himself. But most Americans—and most UN delegates—calmly accepted Arafat as he stepped into the limelight of international respectability over the bodies of dead schoolchildren, Olympic athletes and jet airline passengers.

Strategy & Tactics



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Where was the wrath? Or are we being too harsh on Arafat? Yes, the PLO under his leadership has used random acts of terror and murder to accomplish their political goals. But look at the larger picture: Arafat is only a minor murderer on the international scene.

Think of all the chiefs of state who have addressed the United Nations. Which of them has not had blood on his hands? Khrushchev? Johnson? De Gaulle? Churchill? To their credit, most of the chiefs of state who have stood before the UN have made their killings in organized, acceptable ways. They have used uniformed armies and police forces to do their killing, in a more-or-less professional manner.

Arafat and his PLO terrorists are sloppy and, worse yet, unpredictable. It's not so much the number of people they kill, but the haphazard style they use in killing. People get nervous about terrorists who send letter bombs to their offices, or shoot up airport terminals, or attack schools and apartment buildings. It's so much more soothing to the nerves to be strafed by a squadron of jet fighters or attacked by a squad of combat infantrymen. You have a clear idea of what to expect. With the terrorists, it's the *anticipation* that gets you. The grenade fragments and machinegun bullets are almost an afterthought.

There was very little wrath expressed toward Arafat. Perhaps it's not so much that Americans and UN delegates like terrorism. Perhaps it had something to do with the fact that behind Arafat stood the oil wells of the Arabs, and no one felt quite daring enough to denounce the man as a vicious murderer, with memories of last winter's oil shortages and thoughts of freezing in the dark this winter in mind.

Wrath, it seems, can be considerably tempered by self-interest.

Arafat himself is the symbol of a huge group of people who are closer to real wrath, and more likely to *act* on their anger, than any oil-conscious Westerner. In a very real sense, Arafat represents the wave of a future that can descend upon the entire human race. Most of the world's people are poor, hungry, ignorant, and angry. They don't have the patience of a well-fed American tourist, or the faith that "They" (the company, the government, the leaders) are doing the best they can. The poor are impatient, and becoming convinced that only force—military, economic, or terrorist—can achieve the goals they desire.

These are the people who were talked about, but not really represented, at the World Food Conference in Rome last November. The diplomats and nutritionists politely discussed the problems of feeding the world's hungry masses and, as expected, came to no definite plan of action.

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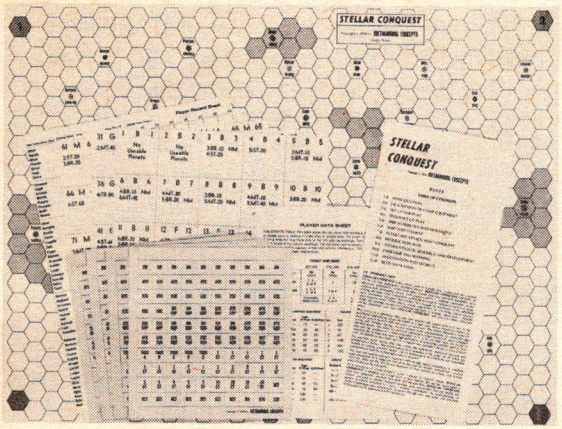
Science Fiction's New Dimension



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The rich, industrialized nations gave their version of the right course to take: let the poor, hungry nations control their population growth; if they don't, they will drag the entire world into a Malthusian spiral from which there is no escape. It makes no sense to feed people who will then breed more hungry mouths that need feeding, said the rich. Implicit in their attitude was that it would be better to let millions starve now than to have billions starving in a few years.

The poor nations had a different view. They demanded aid from the rich; not merely immediate supplies of food, but aid in developing industry so that they can become self-sufficiently wealthy. They pointed out, with some historical accuracy, that the only sure way to curb a population boom is to raise the people's standard of living. Somehow, human beings stop breeding haphazardly when they have solid creature comforts to look forward to for themselves.

But, said the industrialized nations, the aid we have already given you never gets into the hands of the hungry people. A few fat cats take it all and prosper while your people starve. Don't meddle in our internal affairs, said the poor nations. Feed us or we die.

The conference produced rhetoric and little else. While each day 264,000 more people were born into the world, the nations drifted farther apart into two hostile camps: the rich and the poor, the industrialized and the undeveloped, the white and the non-white.

The lessons of the Middle East will not be lost on the leaders of the poor, undeveloped, hungry nations. They can see as clearly as anyone else that there is no morality in international politics—only power. They understand that they do not have the military power to conquer the industrialized nations, although if and when they acquire a few nuclear weapons they can raise terrorism to a new degree. But they do have—right now—the natural resources that the industrialized nations sorely need. And they have the lesson of Arafat and his oil-backed PLO. It is only a matter of time before they are wrathful enough to use their economic and terrorist weapons. On us.

The typical science fiction scenario views the industrialized nations as running the world of the future, just as they have been masters of the world since the deployment of accurate cannon on ocean-going sailing vessels. Yet this scenario could be entirely wrong.

Picture a world of the future where the undeveloped nations rule, thanks to their oil, uranium, copper, phosphates, and all the other natural resources that they carefully ration out to their industrialized neighbors. Most of the world's gold and other real wealth

is concentrated in the hands of these "undeveloped" nations. While the industrialized nations are spotted with crowded, polluted cities wracked by shortages of food, electricity, and living space, the "undeveloped" nations look rather like tourist brochures—uncrowded, clean, balmy. Political dissidents will be working in the mines and farms, out of sight of the palaces and banks where the rich folk live.

The standard of living for these "undeveloped" nations will rise considerably higher than that of the industrialized world, and this will inevitably lead to a stabilization of their population growth.

This scenario begins to look like an updated version of the Morlocks and the Eloi, from H. G. Wells' novel, "The Time Machine." Perhaps it is. If so, we Americans will be among the underground-dwelling, constantly-toiling Morlocks. And how much wrath will we feel then?

Of course, it doesn't have to be that way at all. We could go out and conquer the world, as we did in the 1940's. We'd have to do it the same way we did it then, through an alliance that included Soviet Russia. And then we'd have to feed the whole world and set it back on its feet again, just as we did after World War Two.

Not too many people realize it, but there was an even worse starvation potential in 1945 than there is today. We averted that, thanks to massive aid. And, through far-sighted policies such as the Marshall Plan, we rebuilt our former enemies to the point where they can outsell American-made televisions and automobiles.

If we tried to conquer the world again, however, we would have to rule it firmly for a long time to come. Population control would have to be enforced, and the people being controlled would scream "Genocide!" of course.

But one thing seems clear. Whether today's poor and hungry peoples end up as rulers of the world or victims of genocide, it is *their* wrath that will shape the course of the next century.

THE EDITOR

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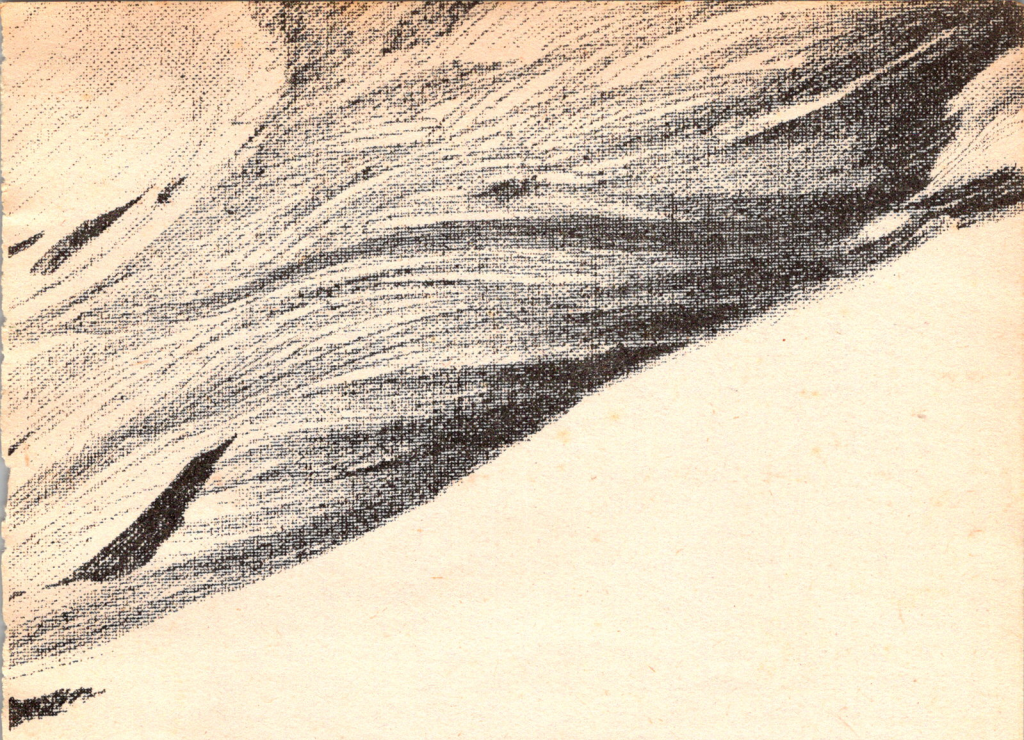

WILLIAM TUNING and EWING EDGAR

JILL THE GIANT-KILLER

The military-industrial complex can be used to make war on a natural enemy.

The continent was new. The land came up from the sea, scrubbed new, and the air moved across it. Clouds grew in the air and cast their shadows. In the dark shadows of the air between land and cloud, the giants walked.

Whelped with the formation of the Mississippi Basin, millions of years earlier, the giants raged in the wake of thunderstorms, were fleeting masters who strode through the primeval forests, breaking and scattering the ancient trees. Present on the land from the time before men lived there, seemingly enraged at the intrusion of fragile creatures of flesh, the cruel giants have stalked that land—destroying, maiming, killing.

As always, they have a way of striking at random. No warning. Any hour of the day or night. They leave behind them smashed houses, broken animals, the mutilated dead, and the orphans of their storms. In the paths of this series of old, blind furies, strong men are helpless as children, and as filled with dread of those great natural powers. The awesome strength of the giants is still so fearfully vast that it has always been accepted as unchallengeable.

Four-year-old Jill lay on a chilly hillside, her face buried in the wet grass, and sobbed hysterically. She was dog-tired from crying and didn't know how long she had been in that place. She had been there a long time, long enough that the tears no longer came from her eyes, though her small body shuddered with wracking sobs which ripped all the air from her lungs and left her shivering for breath.

That morning her mother had dressed her in a yellow-gold dress, as delicate as a butterfly's wing. It was fluffy and light and made her feel very nearly weightless as she pirouetted and curtsied in front of the big mirror in the hall of her parents' house.

She was going to town with Mother and Daddy. It would be pretty. It was springtime on the prairie. Daddy would get the car and bring it up to the house. She could sit in the back seat and look out the window. Coming back to the farm, later, she would sit in the back seat and be surrounded with the nice smells of the groceries. She would snuggle in among the brown paper bags as though she, too, was a sack of provisions.

Suddenly, the mirror nodded away from the wall and shattered in front of her. The whole world seemed to explode at once. The nice house disappeared. Everything was very cold. She was cold and wet. Something was making a terrible noise, like the time the circus lion had roared at her and she had been very scared until Daddy explained just what it was.

Now she was here on this hillside, cold and miserable. She sat up and looked around, but couldn't

see very well. It was raining very hard. She pushed the wet hair away from her face. Mother had braided her red hair just a little while ago, and tied ribbons in it that matched the dress. It had all come unbraided. The ribbons were gone. Her red hair was matted and muddy and wet. Her yellow dress was wet and limp and clung coldly to her.

Jill got to her feet and began to walk through the rain. She wanted to find her mother and daddy. She didn't know how long she walked or where she went. She finally found them, though, where the house had been.

The house was gone, just broken wreckage and lumber spread around the foundation. Daddy was in the yard, near the driveway, and looked as though he were taking a nap on the grass, except that his face and hands were very white and Jill couldn't get him to wake up at all. She was already very afraid when she found her mother, lying in a funny way that looked awfully uncomfortable. She sat down very carefully, next to Mother, and didn't try to wake her up for a while. But it began to get dark and she was more afraid. Her mother wouldn't wake up, either. Jill knew something was wrong, but she didn't know what it was. If nothing happened pretty soon, she thought she might have to get up again, although she was very tired, and walk to her grandma's house. Grandma Kernan lived in California. Jill didn't know how far away that was, but she knew it was a very long way, so it would take a very long time to walk that far. She didn't want to walk any more.

It was raining on Mother and Daddy. That didn't seem right, but Jill didn't know what to do about it. She was very afraid, because they wouldn't wake up, even though she shouted at them and shook them. Finally, she sat down again, next to her mother, and began to cry once more.

She was still there when they found her the next morning. After the tornado and the thunderstorm with it had passed, the Army National Guard had been mobilized to search for survivors and guard against looting. They marveled that the twister had so completely destroyed the house and killed Jill's father and mother without harming her.

No one ever knew that she had been picked up in the vortex and dropped on the hillside over a mile away, but had wandered back and some way found where the house once had been.

Senator Pogue spoke from the chairman's seat at the head of the table. "The committee will now hear the Junior Senator from California," he drawled. "It is our understandin' that she has *remarks* of interest on our budget considerations for Armed Forces Appro-

priations." He smiled, rather vacantly. "Senator Kernan . . ."

Jill Kernan stood, gathered herself, and focused her entire being on the task of capturing the undivided attention of her colleagues on the committee.

She was a smallish woman, with red hair, a Duke of Wellington nose, and a speaking voice which could bust a beer mug at twenty paces if she so chose.

Jill looked up and down the table with what she hoped was an intimidating gaze. Senator Pogue, the senile-looking committee chairman, sat unblinking, giving no sign that his hearing aid was working or that he was even alive.

Jill spoke. "A constituent of mine—one who is highly regarded in the scientific community—has come up with a suggestion of really constructive merit which is of immediate material benefit to the taxpaying electorate. I urge you to give it your most serious consideration."

The alert members of the committee—those who had serious regard for the public trust of their office, and those coming up for reelection—pricked up their ears and gave Jill their close attention.

"What he proposes," she said, "is one method of keeping our military in fighting trim and on its toes technologically. He has conceived a peacetime mission for the Air Force that will save some hundreds of lives and half a billion dollars in property damage *each year.* Right here at home."

Senator Pogue, still staring straight ahead, slowly lifted his right hand, pointed toward the ceiling with his index finger, and scratched the top of his ear. His expression did not change.

Jill Kernan had paused, uncertain of the chairman's gesture until the finger had crooked and scratched the ear rather energetically. She exhaled noisily through her nose and continued. "What is proposed is air warfare against a natural enemy which has been destroying our farms and towns, and killing and maiming our people since the Pilgrims landed. My scientist friend has assured me that our existing weapons capability has the technology equal to the task of killing tornadoes."

She paused and smiled, quickly repeating herself in the second of silence which followed. "That's what I said—*killing tornadoes.*"

There were the expected exclamations and mutterings among the committee members. Chairman Pogue's left eye made two tics in rapid succession.

Jill waved her hand gracefully for silence. "Senator Tannenbaum? You wished to say something?"

"Yes, Senator Kernan. Thank you." Jake Tannenbaum smiled. "I find myself in full agreement with what you have just said, but—ah—I am a mite skeptical as to the feasibility of Dr. Graham's ideas in ac-

tual practice. Your scientist friend is Vernon Graham—yes?"

Jill nodded assent as Tannenbaum continued.

"I think," he said, "it would be a good idea for Dr. Graham to give us a detailed briefing of the scientific basis on which his new proposal rests."

Jill Kernan's Senate office was purposely decorated so as not to betray that its tenant was a female, but clues to the fact were still stuck here and there, like plums in a pudding. The flounced dust ruffles along the bottoms of the couch and chairs, the vanity table and mirror in the combined bath and dressing-room, the lavender and yellow flowered umbrella hanging on the hall tree . . . and, next to the window, an easel and sketch pad.

Jill had never sold a nickel's worth of her art. When she was a teen-ager she had tried—and tried hard, with the same bulldog obstinacy she brought to the Senate floor—to make money with her drawing. Now, the watercolor pads accumulated behind a file cabinet at the rate of about one foot per year. Measurement of the stack could tell one the length of her term in office.

"Yes, Vern," she was saying into the phone. "Next week's regular meeting." She nodded vigorously at Dr. Graham's reply. "Hell, yes, Vern. I know that. I've got Tannenbaum locked up, and Carson is slipping into my pocket. More will start coming around after you've talked to the committee. You're a respected Nobel Laureate in physical chemistry. A male one. It's the dinosaur brigade that has to be rolled over and crunched."

Jill sprang to her feet and began to pace her office, trailing the long phone cord behind her. "Don't worry about that," she said. "I'm having lunch with my Air Force 'spy' today. I'll pick out the man to head the project command before I start feeding reaction pressure into the Joint Chiefs."

Chelsey Quincannon was primarily a girl—a fact that shone through her personality even when she was in uniform. She was Miss Chelsey Quincannon first and 1LT C.L. Quincannon, USAF, after the fact—even though she was an avowed career officer, qualified all-weather fighter pilot, and held a degree in aircraft engineering.

Her duty station at Andrews AFB near Washington DC made her a handy source of casual information to Jill Kernan. Not only was Chelsey assigned to the Air Force Systems Command HQ, but she was very popular with military hostesses and frequently invited to Washington social events. She was a fashionable guest—beautiful, black, very personable, very intelligent, very good company, very discreet, and very good at thinking on her feet.

Chelsey smiled across the luncheon table, rubbed the back of her neck and adjusted the collar of her blouse. Civilian clothes had seemed to be in order for lunch with a friend in the Senate.

"Cantwell's not your man," Chelsey said. "Physically, he's a wreck. As a commander he's—oh—too rigid—usually about foolish things."

Jill crossed the name off the list.

The lady Senator and the lady Air Force officer were tucked away at a quiet table in the Mayflower Hotel. The Sans Souci or any place like it would have been too public. Starting with the long-necked clams they had begun working over a list of potential commanders for the Anti-Tornado Program. Jill had researched a likely group of senior officers. Chelsey was a first-name friend of most of them. She also knew them by their reputations inside the military, that secret heart of reality and truth rarely revealed to civilians.

The dessert arrived. "That leaves us," Jill was saying, "with Commander Jarrell, Captain Pellourne, and Colonel Hammer. Let's see—we put Colonel Harrison on hold."

Chelsey dipped into the banana cream pie, swallowed thoughtfully, and pursed her lips. "Jarrell's a young hot-shot. Has combat experience. Heavy combat experience. But I think he ought to have more seasoning before he takes an experimental program command. He's—you know—kind of brash.

"Now, Pellourne has the brains, but lacks guts. He's never held a command, either at sea or ashore, although he likes to let on that he has. He don't know crap about handling people. Abrasive. He ruffles people up because he don't know anything about how to smooth feathers.

"That leaves us with Harrison and Hammer. Of the two, I'd pick Hammer—hands down. Now, Harrison is all right, you understand, and he has just as good a record as Hammer, but he lacks color. I mean—he's—oh, hell—just not appetizing. I think the pigeon you need for the slot needs to be a guy with a certain amount of dash. Hammer is a good-looking dog, photographs well, and is a gifted bull-slinger."

"Yes," Jill replied. "He should be someone who can capture the public's imagination. We'll need that to get the taxpayers on our side. Until we prove the program—*this* program—good ol' Thundercheeks Thurlow will fight it fang-and-claw. He'll have some *other* version of the same thing—*his* version—*his* program—to build up *his* image, *his* publicity. He'll build it on *my* grave, if I let him." She angled her fist against her jaw, collecting her thoughts. "So—the squadron commander, at first, will have to be one hell of a leader—a guy who does not make mistakes. How does Hammer stack up on that score?"

"Dreamy." Chelsey looked

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fondly at the paneled wall of the dining room, without actually seeing it. "You've looked at his fitness report from when he was a unit commander in Southeast Asia? Strike records, decorations, *very* low losses, number of individual missions he led in person, the quarter-million-piaster price on his head that the NVA offered. All of that?"

Jill nodded.

"It's all true. You know? All straight. None of it is glossed up to make his record look good. His own people call him Colonel Dan. That's respect you don't often find in our business."

"Sounds like our man," Jill said. "I'll put out some other feelers on him—from a more technical end of things."

"I want," Chelsey measured her words, "to be one of the first pilots in the program. That's my price."

Jill sat back in the chair, abruptly. "Hell! I don't know about that, Chelsey. Air Force doesn't consult me when they make assignments."

"You can swing it," Chelsey replied flatly. "I'm getting damned tired of the various ruses I have to use to keep my flying hours up, and I'm getting rump-sprung from piloting a desk at Andrews. This here tornado-killing romp is the kind of slot I've been waiting for. I'm qualified, I can do the job, and

it's a chance to strike a loud blow for women. I won't settle for less."

Dr. Graham paused a moment to discover if there was elaboration or addition to the question from the committee. He adjusted his steel-rimmed glasses with a single, austere motion.

"The point is, ladies and gentlemen, that this is the Achilles' heel of the tornado, right here where the funnel cloud blends into the overcast." He indicated the spot on the projected photograph slide with his light-wand. "Although a tremendous amount of thermal energy is driving the whirlwind, it is attenuated upward from this focal point. This is the spot where the tornado—the vortex structure—is most vulnerable. I believe that a relatively small thermal bomb detonated in or near the head will interrupt the flow long enough to cause a general breakup of the fatal vortex structure."

"And just how big," asked Senator Thurlow abruptly, "is this here *relatively small?*" Sam Thurlow stomped down hard on the words *relatively small.* He cleared his throat noisily, making his jowls quiver. When certain that he was the new center of attention, he carefully ran his hand through his thick, gray hair. He was vainly proud of his gray hair, and wore it styled in a longish version of the "elder statesman" cut. "I don't know much about engineering, Dr. Graham," said Senator Thurlow, "but I *do* know that dropping bombs is a dangerous business. So—how big a bomb are we talking about?"

"It might weigh as much as five tons, Senator, but that isn't a relevant way to describe it. It would not be like a conventional high explosive bomb. I'll go into that shortly. First, let us get a little better acquaintance with the enemy we aim to kill with such a bomb." Dr. Graham punched the cord switch and flashed a new slide onto the screen. "What we see in the funnel cloud of a tornado, which may be several *hundred* meters in diameter and thousands of feet tall, is the condensed water vapor whirling in the vortex."

Graham continued. "What determines the shape of the tornado vortex is where the wind isn't. It's an analog to the eye of a hurricane—the low-pressure region around which the air is rotating as it spirals upward to higher levels. The upward velocity alone may be in excess of one hundred and fifty miles per hour, but the rotational velocity on the wind is much greater—on the order of three to six hundred miles per hour, depending on the size of the monster itself.

"Now, let me conclude quickly by returning to my earlier point. My calculations indicate that a chemical bomb, weighing about five tons, exploded in the head of the tornado vortex should interrupt

the flow and break up the vortex structure. Such a bomb would be designed to generate more heat energy than blast energy. First, the fireball would raise the temperature of a large mass of air rapidly enough to destroy the convective motion—the violent upward flow pattern of the air at the top of the vortex. Second, the pressure wave would disrupt the vortex flow in the funnel below."

Jill Kernan got to her feet and walked to the window, arms folded. "Dr. Graham," she asked thoughtfully, "how can a bomb of this sort and size be used without posing a serious threat to the people and real estate in the immediate area? As far as—uh—civilians are concerned, how safe—or how hazardous—is the kind of operation you describe?"

"About the same as throwing your hat into a landslide," he said.

Vern Graham quickly caught Jill's admonishing stare, which came as Senator Thurlow was gathering himself for an acerb comment. Graham continued quickly. "I do not mean, of course, to be facetious. The bomb would explode at an altitude of several thousand feet over an area already being ravaged by a tornado, but no one nearby spared the tornado's destruction should be exposed to another threat just as deadly—or at all deadly. The bomb will be proximity-fused to detonate above a preset altitude. Sensors in the fuse mechanism would not allow it to explode below some optimum altitude. Additionally, the bomb casing would have to be a plastic material, to be consumed by the blast heat, rather than shattering into fragments. Pyrolon fills the bill nicely in that respect. Its chemical structure would aid in controlling the size and shape of the fireball. Explosion occurs more slowly in a thermal blast. A Pyrolon casing—a thick and heavy one—would control such a blast in terms of size and shape."

There were rustlings from the head of the table; sounds like parchment rubbing on sandpaper. Senator Pogue was going to speak. He cleared his throat. "Dr. Graham, ah'm very much *dis*turbed by the grave danger to which you would expose our highly trained—expensively trained—military pilots. Ah was born and reared in twister country. The very sight of those devils a-stormin' across the prairie—th' very *sight* of 'em—sends brave men down into the cellar like a badger into his hole when the hound-dog approacheth. Giants brawling in the skies. That's what we called tornadoes when ah was a boy. An' you'd best get out o' their way, or they'll step on you with never a notice. As ah say—sendin' our boys aloft in frail aircraft, when even th' birds would be grounded . . ."

"Excellent point, Chairman Pogue. An excellent point." Jill

quickly stepped on the middle of a sentence, before Senator Pogue could get his oratorical machinery cranked up. She turned toward Graham. "How dangerous is the job for the pilots flying the bomb run?"

"I am concerned, too, Senators. The danger to the pilot is a very real one. The stress on his aircraft in the highly turbulent air surrounding the tornado is most serious. It can be minimized by launching the bomb from a safe distance and remaining in the turbulent field as briefly as possible. The pitch-bombing technique—perfected by the military services decades ago, and still widely used—is ideally suited to this purpose."

Senator Jill Kernan added her remark, adroitly timed to set up a certain patriotic inertia. "I wouldn't expect our flying officers to shrink from this kind of combat. They are brave and able men, and courage is the rule with them, rather than the exception."

"You are right, Senator Kernan," chimed in Thurlow. "We all have ample reason—both as legislators and as common, God-fearing citizens—to be proud of our air services. They are the best-trained, the best equipped in the world, and they are manned by the finest pilots on the face of the planet—fearless in their vigilance and ever ready to protect freedom without regard to their personal safety—"

"Are your remarks going anywhere," snapped Jill, "or are you making a speech?"

"Here, *here!*" chirped Senator Pogue as he rapped the gavel. "Committee members will not squabble in this chamber!"

"I apologize," Thurlow serenaded. "We are all becoming a bit drawn, perhaps. I have one further question of Dr. Graham, and then it is my suggestion that we recess for luncheon."

Vern Graham nodded for Thurlow to proceed with his question.

"Is it all worth it?" Thurlow asked flatly.

Jill Kernan started in her chair as though she had been jabbed with something sharp.

"I'm afraid I don't follow you—exactly," Graham said.

"Suppose," Senator Thurlow said thoughtfully, gazing at the ceiling, "just suppose this project of yours *could* eliminate all the tornadoes that take place in a year's time. How much help would that be to the country—aside from the 'practice' it would afford our combat pilots, or at least a select group of them—in terms of cash money? I mean, what would it do for us in dollars and cents?" Thurlow sat back and brushed a strand of hair from his brow.

Vern Graham lifted his glasses onto his forehead and wiped perspiration from the bridge of his nose. "I think I can understand your question, Senator," he said measuredly. "In that connection, I

have one more slide series I would like to show you."

The projection screen flickered alive once more. In rapid succession a dozen pictures were thrown onto the screen—gruesome pictures, brutal pictures.

The first shot offered a wide-angle aerial view of an entire town reduced to rubble and kindling by a tornado. From that grim beginning the pictures snapped into life on the screen, and gradually pulled down into an increasingly tight concept to deal with more and more personal tragedies of tornado damage. Dr. Graham left the last picture on for a full five seconds. It was a close-up of a wrinkled old woman. She was sitting on a broken rocking chair, amidst the ruins of a smashed farmhouse, her face worn and haggard and dirty, with two clean streaks on it where the tears had washed the dirt away.

The committee members were hardly breathing.

Jill Kernan was shaking, and a row of perspiration lined her forehead. She was surprised and unsure of her own reaction to the slides. *The pictures are strong stuff,* she thought, *but I've never had* this *kind of heebie-jeebies before.* She hoped no one would notice. She fought to pull out of the unfamiliar reaction.

Senator Sam Thurlow noticed, though. He eyed Jill sharply for a moment, without her knowing, and scribbled a note on the scratch pad in front of him. He tore off the page and put it in his pocket.

Vern Graham caught Jill's reaction, too, and it puzzled him. He had carefully planned this part of his presentation, to the extent of having a colleague in motivational research arrange the slides.

Graham snapped the button loudly and the haunting picture of the tornado victim was replaced by a neat statistical abstract chart. He began speaking in a flat, business-like manner. "Based on averages over the past five-year period, this is what we have harvested from our tornado crop, *each year,* in the United States of America.

"Seven hundred and thirty-one separate tornadoes. One hundred and ninety-two killed. Four hundred million dollars in property damage, not counting direct damage to crops. These are averages, ladies and gentlemen, but the enemy is more capricious than these figures indicate. The 'giants brawling in the skies,' as Chairman Pogue has so aptly called them, are deceptive in their destruction—elusive of analysis by mere cold arithmetic. The Department of Commerce has been keeping records of tornado damage since 1916. During that time the most tornadoes were recorded in 1965—nine hundred and fifteen of them killed two hundred and ninety-nine people. Yet, in 1925, there were only one hundred and nineteen tornadoes, but the death toll was seven hundred and ninety-four.

That year of 1925 is somewhat out of context, though, because it included the worst recorded tornado disaster. Aside from 1925, the highest death rate was in 1936—one hundred and fifty-one tornadoes; five hundred and fifty-two killed."

"As a matter of curiosity," Jake Tannenbaum inquired, "do you have the figures on the worst single tornado, Dr. Graham?"

"I do, sir." Graham adjusted his glasses and looked at his notes. "On the 18th of March in 1925, a single tornado swept through Missouri, Illinois, and Indiana. During that one day, six hundred and eighty-nine Americans died." He paused for effect, and to let the members of the committee make mental comparisons with their individual concepts of what was a tragic natural disaster.

"I don't have statistical data on the property damage and cost in crops destroyed," Graham said. "Only that six hundred and eighty-nine persons were killed that day. After that, and much closer to us, one black day in April, 1974 the land was devastated from Texas to Ontario by a single massive storm that spawned no less than two dozen tornadoes in a period of twelve hours. Thousands of homes were reduced to confetti. In some places dwellings were scoured down to the foundations and the cement blocks scattered. Material damage approached a billion dollars. But worst of all, over three hundred and forty men, women and children perished in those terrible winds. Isn't it about time we challenged this enemy in the field?"

Vernon Grahan took off his glasses, folded them, and carefully put them in his jacket pocket. "In 1925 we possessed neither the aircraft nor the technology to declare war on tornadoes in any kind of effective way. In 1974, we were nearly able to do it. Today, however, we *can* do it. And, wonder of all serendipitous wonders, it can be used to fight tornadoes in a program which will *save* the taxpayers more money than it costs them. It is not even necessary to put a dollar value on a single human life to arrive at the mathematical relationship. *Property damage averted* will by itself justify the cost, and the lives saved are just a bonus."

"However," rumbled Senator Thurlow, "that is true, sir, only *if* your program works."

Vernon Graham laughed out loud. "That is what I'm here for, Senator—passing my battered hat for a megabuck or so, craving a boon from the guardians of the public purse in the fond and fervent hope that a vicious form of natural disaster, which pays us hundreds of plundering visits each year, can be struck down. I say that it can, if we have the courage—like the shepherd boy David—to place a smooth stone in our sling and pitch it at the giant's head."

My God, thought Graham, *they've got* me *doing it. Stop me, someone, stop me. Five pounds of rhetoric in a two-pound bag.*

Sam Thurlow stopped in the men's lounge on his way to lunch, knowing that his fellow committeemen would do the same. It had been a rather long session that morning.

"This here Graham fella is one hell of a spellbinder, isn't he?" Thurlow asked of no one in particular. He "harumphed" quietly, not certain that he had been noticed.

Senator Erwin Culpepper Pogue finished washing his face, rather noisily, spluttered into a towel, and blew his nose. As he carefully combed his sparse white hair, he eyed Thurlow in the mirror. "Ah wouldn't worry about it too much, Sam. He's not from yo'r state, so he can't run for yo'r office."

"God damn it, Erwin," Thurlow snapped. "That's not what I meant, and you know it."

"Just funnin', Sam; just funnin'."

"He does—this Graham—have a powerful sales technique," remarked Jake Tannenbaum, as he hitched up his pants and re-buttoned his vest across his ample midriff. "I like what he has to say. That is, it makes—you should pardon the expression—good, practical sense. Hearing practical talk has become a luxury for me, since I went into politics."

"That's what I mean," Thurlow said. "But, it makes sense only if it *works.* I sure as hell don't want to get in further than my knees until we know it *works.*"

Erwin Pogue smiled and screwed his hearing aid more tightly into his ear. "Theory never was yo'r long suit, Sam. How we gonna know? How we gonna find out if it *works*—as you put it"—he made a face to emphasize the word—"unless we give it a whirl? Y'all speak for yourself, but I'd hate like hell for somebody else to make it *work,* after we'd killed the proposal."

"Well, that's what I *mean,* Erwin," Thurlow replied. "This Graham guy—even if he is a bleeding-heart liberal—seems to have a good idea, here. But, he's been listening to that Little Miss Smart Aleck girl from out West. His *application* is too ambitious. I mean, federal programs can draw one hell of a lot of fire, especially if they run wild and get the news people all stirred up."

Senator Pogue pulled at his ear thoughtfully. "What's the alternative, Sam?"

"To a federal program?"

"Of course," Tannenbaum said. They passed back through the foyer of the men's room and headed for the Senate Dining Facility. "Don't let me second-guess you, Sam," he said to Thurlow, "but I would be completely surprised if you hadn't given this some thought already."

Thurlow stepped lightly into the

conversation, testing the water as he went. "Well, you got to understand that I'm not opposed to this tornado-killing scheme—*on the merits of the proposition.* It's a fine idea. But, it rankles me for people to just *assume* that things like this *have* to be *Federal* programs, with a capital *F.*"

"The white knight of states' rights takes up his shield, eh Sam?" Tannenbaum smiled cynically.

"Carpetbagger!" Pogue remarked absently.

"Hold on, boys," Thurlow said. "I'm serious about this. Think for a minute. What is our normal posture of reaction in a natural disaster? Flood, fire, hurricane, blizzard—*and* tornado?"

"We know, Sam—mobilize the National Guard. Provide transport. Evacuate victims. Protect property. Direct traffic. We know."

"Of course," Pogue interjected. "Local folks know the local situation. They're familiar with the ground. Our militia—'scuse me—National Guard are local folks. They're right there. They can be on the job in less than an hour's notice."

Thurlow smacked his fist into the palm of his hand. "*That's my point!* It appears to me that this tornado-abatement idea should be combined with the Air National Guard operations in *states that have tornadoes!* Sixty percent of our military is in reserve components. That's what makes us or breaks us in terms of readiness. And, I can tell you for sure, maintaining flight proficiency is a hell of a lot tougher for an Air National Guard pilot than it is for a full-timer in the Air Force. We can man the program at state level and make it work just as well—*and cheaper*—than any active armed service branch."

"Unfortunately," Tannenbaum said, "tornadoes don't come addressed and delivered to a specific state. You still have to have a very sophisticated radar, communications, and computer net to make something like this work."

"Aw, hell," Thurlow replied. "we're all tied in together with the National Guard Bureau, and with adjoining states. Why, one or two tornado bases in each state that has tornado problems will give you a faster reaction time than a whole scatter of 'em attached to *selected* Air Force Bases. Little Miz Kernan don't know that, though. You see, they don't have tornadoes in *California.* That's why she's hot to ride the coat-tails of this thing as a *Department of Defense operation.* Her lookout for that good old national welfare is just the mash of this situation. What she hopes to distill off of it is party control in the next Congress. I don't like that, and her governor won't like it, either. *He'll* wonder why she's fritterin' around with tornadoes, when she *should* be in there punching for the salt-water plants that farmers *need—right*

now—in her own home state."

"There's something to what you say," Tannenbaum admitted. "But, I'd have to study it more, myself. I'm not sure that National Guard pilots are trained up to a fine enough edge to pull this sort of thing as a regular duty."

"Harrrrrrumph," Pogue interrupted. "Ah cannot speak for the states you two gentlemen represent. But ah *can* tell you that *our* boys down home have always given a good account of themselves when called to take up the sword and rid our land of the dread alarms of—"

"Hold on, Erwin," Tannenbaum said good-naturedly. "We're not going off to fight the heathen, or something. We're just going to bomb some tornadoes."

"You *politicians* are getting off the point," Thurlow rumbled darkly. "The point is, we are involved with a *regional* problem that only requires attention for seven—maybe eight months a year. Now, if that isn't a problem for *local* military reaction and control, I don't know what is. You have Air Force personnel—say—that operate this thing; what the hell do they do with themselves when tornadoes are *out of season!* They keep right on drawing pay and allowances. That's what! We keep an Air Force base open when it's out of business. Think of the confounded *money* that's involved."

Tannenbaum laughed. "Funny you should mention it, Sam, but I was just thinking of that very thing."

"Eh?" Thurlow asked.

"I don't suppose your reaction—here—has anything to do with the fact that you happen to be a brigadier general in your own state's National Guard, does it? You are, perhaps—I don't mean to offend—licking your chops at the prospect of a much larger budget for your own state's military department—more federal money? Does your very attractively and logically stated proposal have anything to do with that portion of your career?" Tannenbaum smiled a bland, Shylock smile.

"It has to do," Thurlow said huffily, "with the *fact* that my own service position *puts* me in a position to know what I'm talking about on this point. I say, 'skunk her.' That's what. But, from a standpoint of harmony, if you boys want to go along with her, I will, too—at least temporarily. In the end, though, you'll see that I'm right about this. Y'all depend on it." He paused.

"Today's Tuesday, isn't it?" he asked, suddenly calm again.

"I believe it is," Tannenbaum said. "Why?"

"If they have baked ham *without* yams again, today, I'm going to raise hell."

"It's not something I think about very much," Tannenbaum replied.

Two days later, over evening

cocktails with Jill, Chelsey Quincannon was saying, "You can call it eavesdropping if you want. I call it 'casual intelligence gathering.' "

They were ensconced, this time, at a corner table in the Mayflower Hotel's La Châtelaine.

Jill waved her swizzle stick impatiently. "I take back the eavesdropping part. Daniel Hammer—our own Colonel Hammer—is raising hell about being considered for the tornado program. Then what did he say?"

"Well." Chelsey paused to smile broadly. "When he found out the tornado program outfit will have one-third of the active pilots *female* officers, he really hit the roof. You wouldn't believe the *language!*"

"I can believe it," Jill said calmly. "So, he doesn't want the job?"

"Doesn't want the job? He's kickin' an' bitin' an' clawin' to get out of it. Doesn't want anything to do with it. But, look here, Jill. This is really kind of a dirty deal. I mean, he *is* due for brigadier, and he deserves to get it."

Jill arched an eyebrow. "Where is Colonel Hammer now?"

"Well," Chelsey replied, "he took off up Suitland Parkway with his afterburners roaring and his tail surfaces on fire. I'd say he was likely at the Pentagon, pulling some string."

Jill nodded. "Exactly. Even as we sit here, holed up in this friendly establishment, plotting darkly, Colonel Hammer is holed up in some officers' club bar with one or more of his colleagues in high places, likewise plotting darkly—aimed at countering our plotting. Nonsense." She snapped her fingers to emphasize the point. A waiter appeared from nowhere. "Oh, dear," Jill said, "I didn't mean—oh, well. Bring us two more.

"Anyway, Chelsey," she continued, "it's the fortunes of war. I *need* Daniel Hammer for this program. The more I learn about him, the more convinced I become. He's the bull for the job, and I have to cover all my bets as many times over as I possibly can." Jill leaned closer and lowered her voice. "It's history, dammit. We always wind up doing things for men, which they bellow and stomp about, but which are for their own good in the long run. As soon as the program gets off the ground, Hammer will get his star, anyway."

"Unless something goes haywire," Chelsey replied evenly.

After a long wrangle in committee, funding was approved for an R&D program which would test Dr. Graham's theory about tornado-killing.

Frankford Arsenal would supply the experimental bombs. The Lockheed "skunk works" would modify F-4J Phantom II aircraft to be supplied by the Navy. Congress had in no way furnished enough funds for

the project to contract with McDonnell-Douglas—the builders of the versatile but now aging Phantom—for new aircraft. Second-hand would have to do until tornado vulnerability had been proven.

The Navy would prove the bombs at sea on the Pacific Test Range. The Air Force would conduct dirty-weather flying qualifications in the North Atlantic from Pease AFB. Dr. Graham would coordinate the assembly of personnel and equipment for a joint Air Force/Navy unit which would carry out the first experimental attacks on "live" tornadoes. If Jill Kernan got her way, Colonel Dan Hammer would be its first squadron commander.

If actual kills were scored by the unit, it would be permanently assigned to man the first anti-tornado station, to be located on an Air Force Base somewhere in the heart of prime tornado country. Finally, other stations would be activated as rapidly as funding could be approved, so as to build an effective network over the central and southeastern United States.

Senator Jill Kernan had spearheaded the approval of her project, counter to the system visualized by Thurlow. She had scoured the cloakrooms for support, wheedling and cajoling. When that didn't work, she bullied and brow-beat. She threw cocktail parties for apathetic legislators and various third-assistant-under-secretaries who had little authority but were capable of expediting paperwork for one project while bogging down another in endless red tape.

She ground out releases for the press. She wrote articles and gave interviews. She faced down leonine old colleagues on the floor of the Senate when they sought to censure her for "shamelessly publicizin' pet projects," and "logrollin' like a snake-oil peddler."

And, she tacked a zig-zag course to fly through a thick storm of flak from politicians in her own state. They could only see federal funds slipping through their fingers—federal funds going to an anti-tornado program which *could* have gone to California, if the state's Junior Senator had taken less interest in the price of corn in Kansas and put more fight into legislation intended to benefit the state she was supposed to represent. They had no idea of the fierce drive that moved Jill Kernan to wage war on tornadoes. She, herself, did not fully understand the thirst in her for vengeance that swept her relentlessly on to the final conclusion of her battle against the killer whirlwinds.

Now, after three months of push and pull, the first three-plane flight of the Anti-Tornado Program was being made operational. It was a bone-weary Jill Kernan who opened one wall panel in her office

and switched on the television. While it was warming up, she opened a second panel and fixed herself a drink. As sunset shadows lengthened across the lawn outside her window, she kicked off her shoes and settled on the couch to watch the news.

That afternoon a military jet had been ordered to change flight plan and set down at Offutt AFB, Nebraska. As he got off the plane, an outraged Colonel Daniel Hammer was handed a set of orders with the ink still damp on them. He quickly read the orders, muttering unspeakable oaths to himself. Then he took off his forty-dollar uniform hat and threw it down on the concrete apron as hard as he could. He might have stomped on it, had not a junior officer snatched it up and returned it. Hammer ran his fingers through his salt-and-pepper graying hair, jammed the hat back on his head, and loped across the runway, his large, long-legged frame chewing up the distance between his plane and the headquarters building.

It did him no good. His command had been assembled, and he was to move at once to Wichita, where he would make connections with the modified Phantom jets, the personnel, Dr. Graham, and the giant-killing bombs—all waiting for him at McConnell AFB, Kansas.

Before Colonel Hammer's plane departed Offutt for McConnell, he had time to get on the Autovon and place a call to Senator Kernan in Washington, DC. Although the telephone log showed the call's duration to be only four minutes, Colonel Daniel Hammer managed to fit in three suggestions about Jill's ancestry, five remarks of a distinctly "male-chauvinist sexist-pig" nature, and used fourteen phrases of a sufficiently profane magnitude to make the switchboard monitor—a grizzled master sergeant—wince visibly.

That was the kind of man Jill Kernan wanted in command of the Anti-Tornado Project.

Jill put her feet on the coffee table, sipped her drink, and turned up the sound.

"*. . . Secretary Ian Griphon of Malthus Enterprises could not be reached for comment, and is believed to be out of the country pending an Internal Revenue Service investigation of a recent stock split . . .*"

Frankford was satisfied that the new bombs were operational and safe to handle, and Dr. Graham had accepted the Navy's refinements on firing techniques after extensive testing at sea.

Five kill tests had been authorized and scheduled to begin in early March, whenever the first tornado turned up close enough to be hit. "Tornado Alley" was the likeliest region, so McConnell AFB on the eastern outskirts of Wichita had been picked for the test operation.

The second-hand Phantom II's modified for the simulated training

attacks at sea were rebuilt and groomed for the first kills. If the project was effective, it could later obtain aircraft modified expressly for tornado-killing and a little more up-to-date than the aging F-4J's.

Jill was already pondering how she could worm the planes away from Defense Department logistics zealots. Of course! Let them keep airframe test data on the existing planes—planes subject to much more rapid stress deterioration than even combat jets, because of the continual use in heavy weather.

". . . pooh-poohed the rumor that he stands to gross over two million from the movie/TV/cassette rights to his latest novel, 'With A Finger In My Ear.' Columnist B.J. Truncheon talked with author Fraidmann in his lush Beverly Hills office complex . . ."

Cuss 'em, thought Jill. *Are they going to cover the story or aren't they?*

The first flight would be at Wichita by now. They had taken off this morning from NAS North Island, moving their own planes to McConnell: First Lieutenant Chelsey Quincannon and Captain Lee Bates of the Air Force and Lieutenant Peter Selby of the Navy.

Selby was the best qualified flier in the bunch. Twenty-six years old, he had been flying since he was eleven. A fast look at his Form 20 and his 214 easily explained his exceptionally high score in the pitch-bombing trials. He had been assigned to the Anti-Tornado Project from the joint Department of Defense Parachute Test Facility at El Centro. He had a long record of dirty-weather flying experience which started when he was a high-school kid in a glider. He had ridden several storms to new soaring records and seemed to be the heir apparent to the reputation of the legendary "Thunderstorm Maxie," one of Germany's early sailplane pioneers. Selby had bailed out with every ejection device and popped every parachute the military had ever thought about. He had logged over a thousand jumps—two hundred and sixty-five of them in experimental devices.

". . . that sparked a riot on the religious sect's communal farm when Father Randolph took exception to the court order and knocked down several sheriff's officers before he could be restrained . . ."

Flight Two had completed foul weather training and was moving into the same pitch-bombing phase just completed by Flight One. Those three people were solid, hand-picked pilots, as well. Major Doris Polanski from Air Force, Lieutenant Commander Harry Rosenthal from Navy, and a colorful Marine pilot, Captain Stanley Lemm. The Marine Corps had put up such a howl that the manning table had been modified to accommodate pilots from the USMC on a direct ratio-of-strength basis.

Lemm should have been a major the previous year, but his seniority on the 0-4 eligibility list had been rolled back as the outcome of an inter-service squabble which had arisen when he shot the landing gear off an Army artillery spotting plane that had aggravated him for some reason which had never been revealed in the board of inquiry hearings.

". . . we all know the story of Jack the Giant-Killer. Here now is correspondent Hanklin Tracey with an update on Jill *the Giant-Killer. Hank . . ."*

"Thank you, Hal. Today should be a happy one for Senator Jill Kernan of California. For several months she has led an uphill fight to establish a tornado-killing program that would utilize combat-trained pilots from all the military services in a project designed to virtually eliminate the threat of tornadoes. The project was officially launched today by its civilian director, Dr. Vernon Graham, and the project's first military commander, Air Force Colonel Daniel Hammer. The two posed for photographers alongside a new type of thermal device which Dr. Graham has designed to break up tornado winds. After a ribbon-cutting ceremony, both men held a news conference at McConnell AFB, near Wichita, Kansas, where the experimental phase of the project will be located. Operation Giant-Killer, as it has been dubbed, will, it is hoped, prevent millions of dollars of tornado damage annually, and save hundreds of lives.

"While Dr. Graham fielded technical questions from reporters, Colonel Hammer outlined the military applications of Operation Giant-Killer, pointing out that the project involves practically no 'cost to the taxpayer, since it affords a productive program by which military pilots will maintain their flying proficiency at required readiness levels and still be of continuing service to the American public.

"Colonel Hammer expressed pride in being selected as the first commander of the joint force, and hailed the project as a milestone in the cooperation he feels should be more frequently practiced between the military services and elected civilian authorities.

"Reached earlier today in Washington, Senator Kernan lauded the qualifications of Dr. Graham and Colonel Hammer in . . ."

The crucial phase of Operation Giant-Killer was launched quite literally with a bang.

They had no sooner uncrated Dr. Graham's new eggs and gone to work than the tornado watch sounded the first alert. One plane was serviced, armed, and on the line, and another was almost ready when the word came that something was brewing in a thunderstorm which had rolled over the southern edge of Kansas. Soon, a full-grown twister was striding

northeast—toward Wichita. The roaring wind could be heard for more than fifteen miles and was still building.

Colonel Hammer was gone in the AirMobile van and couldn't be raised on the radio.

There wasn't time to wait for the Colonel. As Lieutenant Selby climbed into the cockpit of the readied Phantom, he was giving orders for a second plane to be put in the air as a backup. The crew chief buckled him in and hooked up Selby's commo and sensing leads. He handed him a T.W.X. that had printed out on the teletype minutes earlier.

SELBY: LEADER: JILL-FLIGHT ONE:

918TH TEST SQUADRON JOX(DOVJ)76566:

MCCONNELL AFB

JILL THE GIANT-KILLER WISHES YOU GODSPEED AND GOOD HUNTING.

KERNAN

WASHINGTON

Selby grinned. "She couldn't have timed it better, even if she knew what was cooking. This just come in?"

The senior sergeant nodded. "Personal messages to everyone in Giant-Killer Command. You should see the one sent to Colonel Dan," the sergeant shouted over the scream of the plane's engine as he unhooked his workstand.

Selby guffawed and waved at the man on the ground as he pulled down his canopy and locked it. He pushed the throttle and began to creep across the apron.

Strong gusts were rocking the plane as Selby taxied to the end of the runway. "Jill-One Leader to tower. Time's wastin', control. I go."

"Tower to Jill-One Leader. Go, Leader. You're the only guy in the barrel."

Selby talked smoothly and without pause in his routine as he turned into the rising wind and kicked in the after-burners. The plane went up like a rocket, riding a shaft of flame, and clawing for altitude. The jet blast momentarily muffled the sound of the charging enemy, but Selby could soon hear it again, even through the plane's canopy and his own helmet. As soon as he was above the trees and had eyeball contact with the horizon, he could see the tornado. He was flying through air as heavy as any he had ever handled.

He swung out to flank the giant, gaining altitude and distance as he banked through a long lazy-eight that brought him back into the general line of the tornado's advance. "Jill-One Leader to Giant-Killer Control. Do you have a new heading on target?"

There was a long pause, then a scratchy voice over background noise—faintly. "Break-break. Uh—Jill-One, this is Giant-Killer Ten. Giant-Killer Six talking. Control not reading you, but we copy traf-

fic on both. Hold your pattern, sailor. The Ten computer is thinking about you and enemy. Six over."

Giant-Killer Ten was the call sign for the commo van, which was also ground net control, and Six was the Squadron Commander's personal sign. Selby was relieved to hear Colonel Hammer's voice on the radio.

"Roger, Six. I copy. Glad to hear from you. The Air Force came to town. Jill-One over."

"Roger, Jill-One," Hammer said. "We're about twenty clicks west of Giant-Killer Control. The monster is veering our way, now. Our bearing to Control is seven-two. Target bearing five-two. Fill your bank and come to attack heading of two-two-niner. Computer confirm; two-two-niner. Target distance from Giant-Killer Control—reference Giant-Killer Control—seven-one air miles. Target speed, two-four knots, max altitude forty-one hundred—four-one-zero-zero feet. *And*—computer confirm; attack speed five-two-zero—five-two-zero knots—at two-four-zero-zero feet altitude. Uh—Jill-One; how do you copy computer confirm? Over."

"This is Jill-One. I copy data, Six, and now store input." Selby repeated the figures as he punched them up into input storage, ready to release into the attack computer on board. "Input now stored, Six. Request Computer Analysis Update. Over."

"Roger, Jill-One. CompAn Update working. Your input is go. CompAn readout confirms. Insert attack program as soon as you are on bearing two-two-niner. Over."

"Roger, Six. Jill-One on attack bearing, and input now inserted in on-board program. Do I have your permission to attack this baby?"

Hammer's voice came out as a strangled laugh. "That's a rodge, Jill-One. Readout shows me right in the path of destruction. You're driving the airplane, sailor. Go for his throat. Giant-Killer Six out."

Selby steadied in under the churning clouds, found the course overlay as he dropped a sonic boom on the little town of Millerton, and idly thought that the residents probably didn't even notice the shock wave. In his reticle loomed the most formidable form of foe he had ever faced; a whirling black giant five hundred meters in diameter and over four thousand feet tall. He throttled down, dropping to the prescribed speed and altitude, then tapped his mike twice and left it open as he counted down. "Jill-One to Giant-Killer net. Coming up, coming up. Crossing I.P.A. . . . Mark! Locking on auto attack at mark . . . Three, . . . two, . . . one—mark!" A second's pause. "Damned rough air. I can see the wings flapping on this old bird. *Egg away!* And, away we go! Up! Up! Up! Orville and Wilbur—pull me up!"

Selby's plane dug a furrow

through the clouds as the bomb departed on a long, rising trajectory. Instead of rolling out on top, in the sunlight, he continued to loop over, back onto his course, and came back down in the swilly weather—farther away, but still in full view of the tornado. The bomb, buried square in the monster's head, had just exploded.

On the Harper-to-Viola road, Colonel Daniel Hammer's men had pulled the AirMobile van into a shallow creek and sheltered in close to a road bridge, putting the bridge between themselves and the tornado. As soon as radar confirmed the shot, they piled out of the van into knee-deep water to watch the tornado blow up—or take cover under the bridge if it didn't.

The tornado was less than a mile down the road, tearing up billboards and trees as it came, chewing up the fragments and broadcasting them on the wind. The sound was deafening.

The men on the ground saw the fireball rip a hot spot in the overcast. Seconds later the shock wave rocked the van and rattled loose gear inside it.

Someone shouted something that couldn't possibly be heard above the roaring, dirt-laden wind, but they all saw that the bomb shot was in the bucket—right on the money.

With mounting concern, Hammer waited, wondering if the twister could blow down the stone bridge. Was it working? Then, as though someone had dropped a plug into a drain, the head of the vortex broke up into a cluster of furious eddies. The whirlwind ran down like a dying top. The full-blown funnel cloud simply evaporated.

Suddenly, it was quiet. The wind was still violent, but compared to the din of a moment ago, the world seemed abruptly silent.

Colonel Hammer and his well-disciplined ground commo crew dissolved into a mob of cheering, laughing madmen, hugging and pummeling each other as they were engulfed by a harmless cloud of whirling dust and dirt.

Lieutenant Selby, also intoxicated with delight, buzzed over them at treetop level, pushing the speed of sound. He waggled his wings impudently and pulled up into a series of three tight victory rolls.

Moments later, at the airfield, it was a beaming Dr. Graham who gripped Selby's hand warmly. ". . . Beautiful piece of work, son. I think we're onto something, here. Let's have a little de-briefing over in the maintenance shed. There's some champagne flowing already."

Selby was grinning. "Thank you, sir. We ought to go a little slow till Colonel Dan gets here. Shouldn't be more than a few minutes, though. Let's go. He had the commo van out there right under the twister."

Graham nodded. "I know. I know." He frowned. "What was he doing out there, anyway? I heard the radio traffic."

"I'm afraid to ask him," Selby replied. "*But,* when we crack the second bottle, I probably will, anyway."

Operation Giant-Killer's second kill was made under less impromptu conditions. All three of the modified Phantoms were ready on the flight line when the alert sounded. Chelsey Quincannon drew the lead spot on the flight, and she enthusiastically played a tune on the radio net that had ears ringing for a week afterward. But, she also steadied right down on the money when she attacked the tornado and laid in a "textbook" shot that destroyed the giant before it could travel a dozen miles from its original touchdown sighting.

Colonel Hammer was already slogging through The Battle of the Paperwork. He had three planes in Jill-One. Period. No alternate aircraft; no backup equipment except Vern Graham's clutch of eggs. He didn't care for the idea of having to send up a two-plane flight against a tornado if the third was torn down for maintenance.

Dan Hammer was under enormous pressure to succeed with the mission. A week didn't go by without a flock of civilians settling down at McConnell to roost on his operation for a couple of days. Scientists, congressmen, senators, engineers from Defense, liaison observers, to say nothing of tribes of meteorologists from the National Oceanic and Atmospheric Administration—some of them decked out in their almost-familiar uniforms that made them look like musical-comedy navy officers.

Jill-Two was scheduled to arrive at the McConnell anti-tornado station thirty days after Jill-One. That suspense date was still over two weeks away. It looked like a hairy time ahead before that comforting advent, which would take some pressure from Jill-One and give the crew chiefs a chance to do some really thorough tear-downs and maintenance.

In the meantime, Hammer played the game he knew well. He was the kind of officer who, though discipline-conscious, commands respect and obedience by force of leadership rather than by rank.

He got himself checked out on the modified Phantom II and learned to fly it as well as any of his pilots could. He participated in the pitch-bombing simulations in thunderstorms and "proved up" to all the people in his command—an essential exercise for the man who has to issue the orders and then take it in the shorts if he is wrong.

When the third kill mission came, Jill-Two had not yet arrived, and one of Hammer's aging fighters was torn down for some dental work on its turbine.

Dan Hammer had a bad feeling about it. He told himself it was combat fatigue from The Battle of the Paperwork and sent up the flight mission with two planes. One of the bombs didn't arm and detonated too deeply into the tornado vortex to make a clean kill. The tornado was a "hopper"—it danced back and forth along an eratic course. The second bomb laid on accurately, but the giant sidestepped the shot while the bomb was in trajectory. The tornado was crippled, but it still took out a long strip of real estate in Nebraska while it was dying.

Colonel Hammer and Vern Graham had been raising hell in Washington for five more modified Phantoms to be provided for backup aircraft. So far, it was no dice.

Although Senator Thurlow had voted to fund the project, he had taken great care to see that none of the money was "spent frivolously on featherbeddin' details." None of the Air Force's costly and brand new Mach-3 fighter-bombers were going to be modified until the pragmatic workability of Dr. Graham's theory about tornado-killing had been convincingly and substantially proven.

Colonel Hammer went into a "silent period," chatting moodily with the crew chiefs and the ground exec, taking long walks that looped in long, meandering paths out behind the main runway. He stayed late at night in his office, surrounded with aeronautical engineering volumes, charts, overflowing ashtrays, and coffee cups.

When Jill-Two arrived at McConnell, Operation Giant-Killer was waiting for its fourth alert and a general sigh of relief was felt all over the project. The planes in Jill-One weren't exactly holding up well. The practice missions in heavy weather, combined with strains of actual kill missions, was simply more than the Phantom II had been designed to withstand. There was a pervasive air of jumpiness that turned off much of the early enthusiasm of the project's personnel.

Abruptly, Dan Hammer christened Jill-Two "Egghead Flight," without consulting Major Doris Polanski, who was technically the flight leader. He ordered a flight insignia designed and painted on the planes.

As soon as he had done that, he showed up at the air exec's office and asked for a Jill Flight plane. He was going to Washington and wanted the plane on the line by the time he had changed clothes.

Ten minutes later, he put his foot on the ladder and tossed his flight bag up into the plane.

Less than an hour after he had set down at Andrews AFB, Hammer was walking through Senator Kernan's outer office.

"Colonel!" Jill Kernan's recep-

tionist protested, "I'm telling you the truth! Senator Kernan is *not in!*"

Hammer paid no attention. He swung the door to the inner office, stepped in, looked around, looked in the bathroom, looked in the closet, and only then returned to the doorway.

The enraged receptionist was standing just inside the door of Jill's private office. "Colonel! This is *very* improper!"

"Betcha," Hammer remarked dryly. "Where is she?"

"In a committee hearing," was the crisp reply, "but she won't be back here until after four o'clock!"

"I haven't got that long," he said. "Get her on the phone."

"I'll do no such thing!"

Hammer's eyes narrowed. "Look here, chickie. I'm on the prod today, and I've got business to discuss with her highness that I can't put into a letter and I can't put over the phone lines. You get in my way and I'll wad you up and toss you out the window. Get the lady senator on the horn: tell her I'm here. She can skip out of her meeting for a little while and come over here, or I'll go to wherever she is. I don't care which. Either way, I'm due back at Andrews by lunch time, and I need some answers first. Now, I appreciate the fact that I'm a revolting male supremacist to you, right now, but *move it. Fast!*"

"What the hell is going on here?" snapped Jill Kernan as she stalked into her office. She didn't stop to speak to the receptionist.

"What the hell is going on here?" she snapped again as she entered her private office.

Daniel Hammer jumped briskly to his feet. "Good morning, ma'am." He bowed from the waist. "Just passing through, ma'am. Beg to pay my respects, ma'am."

Jill arched an eyebrow. "Hammer, are you drunk? I swear to God, I'll—"

Before she could finish the sentence, Hammer was at the door, and had closed it behind her. "Stow it!" he said sharply. "That show was just for the front office help. Not only have they never seen a full bull colonel act so—ah—cavalier; they'll be much less interested in the purpose of my visit than if I had showed up in fresh dress blues, all stony-faced, with a dispatch case handcuffed to my wrist."

Jill sank wearily into the large chair behind her desk. Somehow, she felt more comfortable with four hundred pounds of walnut between her and this nut. "Dammit, Colonel," she sighed. "I'm very busy; I don't have time to play spy-spy with you. What is it?"

Hammer picked up the drink he had made himself while he was waiting and meticulously whisked away the wet ring, left by the glass, with his forefinger. "A man after

my own heart. I never cared much for mincing words, myself."

He spun sharply and looked thoughtfully at Jill. "By the way, how do you feel about having someone barge into your office and make himself at home?"

Jill sat up straight in her chair. "I don't like it a damn bit! Now that you mention it, I don't—"

"I don't either!" Hammer cut her short. "Not a damn bit!" Abruptly, he softened. "Nonetheless, madam legislator, I have steadily had to contend with members of your august parliamentary body dropping in at my airbase and wandering around my command as though it were their back bedroom. Thought I'd give you a dose of your own medicine, *but* that's not why I came to see you."

Jill rubbed her eyes tiredly. "*Colonel* Hammer, I have been *trying* to get as many senators interested in Giant-Killer as possible. We're going to need votes when the budget comes up if we expect to keep the project going."

"Commendable," Hammer remarked. "If we spend all our time walking your pot-bellied colleagues around the plant, we won't get our job done, and there won't be any Giant-Killer by the time next year's budget comes along."

"Hammer, did you come all the way to Washington to bellyache about the size of your official visitors' list?"

"No! There's trouble in the glen, your ladyship. Vern Graham and I have hashed it out and we decided it would not be wise to get in touch with you via the usual channels, lest wind of the difficulty reach the wrong nose."

Jill's ears reddened and her hand flew to her own prominent nasal feature.

"No offense," Hammer said. "Figure of speech.

"The problem," he continued, "is that your anti-tornado project is on the edge of failure—unless we get more equipment, more R&D people, more operating funds. I mean it, Jill. You don't mind if I call you Jill, do you?"

Jill laughed nervously. "Why not? You've called me everything else, so far. What's wrong?"

"I've got to have more aircraft. I've been beating my head against a stone wall for weeks, now. The Phantom II is a great little flying machine, but it wasn't built to stand up to tornado-force wind and turbulence any more than the Wright brothers' biplane was meant to hold up in a power dive. Normal preventive maintenance will make the grade for practice work. *But,* after we run one of these babies through a live tornado, we've *got* to tear it down pretty thoroughly. If we don't, sooner or later we're going to have a structural or a control surface failure during a bombing mission. If we have an accident, jolly old Senator Thurlow and his fun-loving gang of

hatchetmen will be after you with tar buckets and goose feathers. They'll jump at the chance to get to you through Operation Giant-Killer. God knows, you've stomped their corns enough that they're spoiling for a swing at you. Killing off the project will 'prove' that Thurlow was right about a federal program not being the answer. He's consistently tried to hamstring us and starve us down to failure level. One, it will get him the tornado program at a state level, and two, he'll get even with you and your party."

Jill smiled warmly. "Why, thank you, Dan." It was the first time she had ever called him by his first name. "I don't know what to say—Thank you."

He spun on his heel and pointed his finger at her. "Oh, don't get the wrong idea. It's not your hide I care about. You've run roughshod over me and mine, too. It's the project I'm thinking of. I want Operation Giant-Killer to get a fair shake. I don't want it blown away by some loudmouth who never fired a shot in anger—some *benchwarmer* who is only patriotic enough to send *other* people to war."

"It's not just the project," she said quietly. "You don't think I'm so big a hick, do you? You've given some hard thought to your own fitness report—and promotion."

Hammer grinned. "There is that," he replied.

"Just how sure are you?" Jill asked. "Surely tornado-killing can't be rougher on the aircraft than combat flying. The Phantom II has held up for long stretches of hard combat work."

Hammer laughed. "Thank you, Miss Pollyanna! The fact is that *any* plane has airframe failures in combat. It just doesn't show up that way, because it gets logged as enemy action. *But,* out there at Wichita, if you lose a plane—worse yet, lose a plane *and* a pilot—the problem is going to stick out like the well-known thumb. You can't hide it. They'll shut down the project as 'too dangerous.'"

"Should suit you fine," Jill remarked. "Then, you'll be loose."

"Crap!" Hammer growled. "I'll admit I didn't like it at the time you railroaded me into the job, but that's just the way I am. Once I get involved with a job, I get involved all the way. I *don't want* the project shut down. I think it's valuable. I think it will turn out some crackerjack good pilots."

"So, what do you need, Dan?" Jill's pencil was poised over her scratch pad.

"We *need* a completely new aircraft, tougher than anything that's in the air. We're not going to get it, because it's a fat chance that ten to fifteen years' time and two billion bucks will be invested in Giant-Killer—not now—not ever."

Jill was staring at Dan Hammer as though he had lost his mind.

He shrugged. "Well, that's what it takes to get a brand-new airplane from idea to roll-out. In the meantime, I'll settle for five more modified Phantoms and some unvouchered access to replacement parts and components. We blew a mission last week because I only had two planes to send up. I've *got* to have some spare aircraft."

"I'll see what I can do," Jill said, "but don't hold your breath. They're really counting the quarters this year—election coming, and all. Oh, don't get the wrong idea. I'm *more* anxious, if anything, to get Giant-Killer on a permanent status before the election. If it's not running slick by the time the new Congress convenes, they could cut off your funds—all of them—in the wink of an eye."

Hammer chuckled. "You don't think I'm so big a hick, do you? You're also thinking of the prestige a successful Operation Giant-Killer could lend to *your* re-election campaign—and your party's chances to gain control next year."

Jill cocked her head to one side. "There is that. I think *I'll* have a drink, now."

"Do you good," Hammer replied. "I'd join you, but I have an appointment for lunch. Do you think I can get the planes, or not?"

Jill dropped ice cubes into a glass—thoughtfully. *Plink. Plink. Plink.* "Not for a while. If *you* can't get them, I can't either—*until* I can find out what's in the wind. Then I can cut some corners."

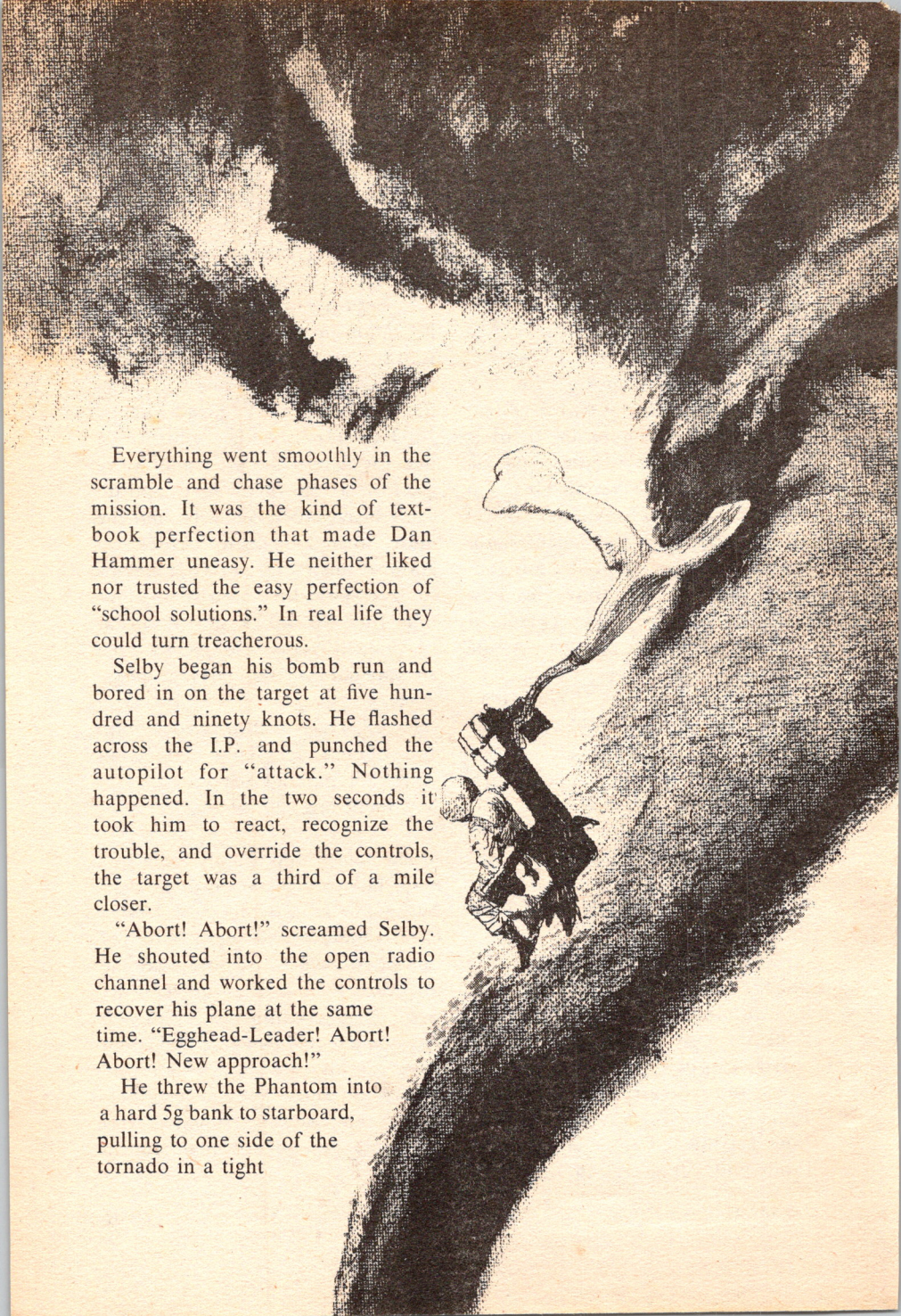
"I can't keep sending those kids in Jill-One up," Hammer warned. "The crates are going to start coming unglued."

"How long can you sit still and make do?"

"About a month." There was no hesitation in his answer. He had alternate operations plans already worked out in his head. "I can throw the load on Egghead-Flight—Jill-Two—for a while. Jill-One is due for a rest, anyway, and we've *got* to tear into their planes and do some heavy work. We'll be into the main tornado season before we know it—heavy flying requirements for everyone. Jill-Three is in training, but we won't get them at McConnell soon enough to take any pressure off this airplane problem."

"Well, Dan." Jill chewed her lip and offered her hand. "Hang in there. I'll pull all the wires I can for you at this end. Shake?"

The fourth opportunity for a tornado kill took the form of a small but evil-looking twister near Dodge City. Hammer had an itch to put himself on the board and lead the mission, but he curbed his own desire for giant-killing. He assigned the mission to Egghead Flight, but covered his bet by designating Lieutenant Peter Selby to lead, bolstering Jill-Two's first mission with the most experienced man out in front.

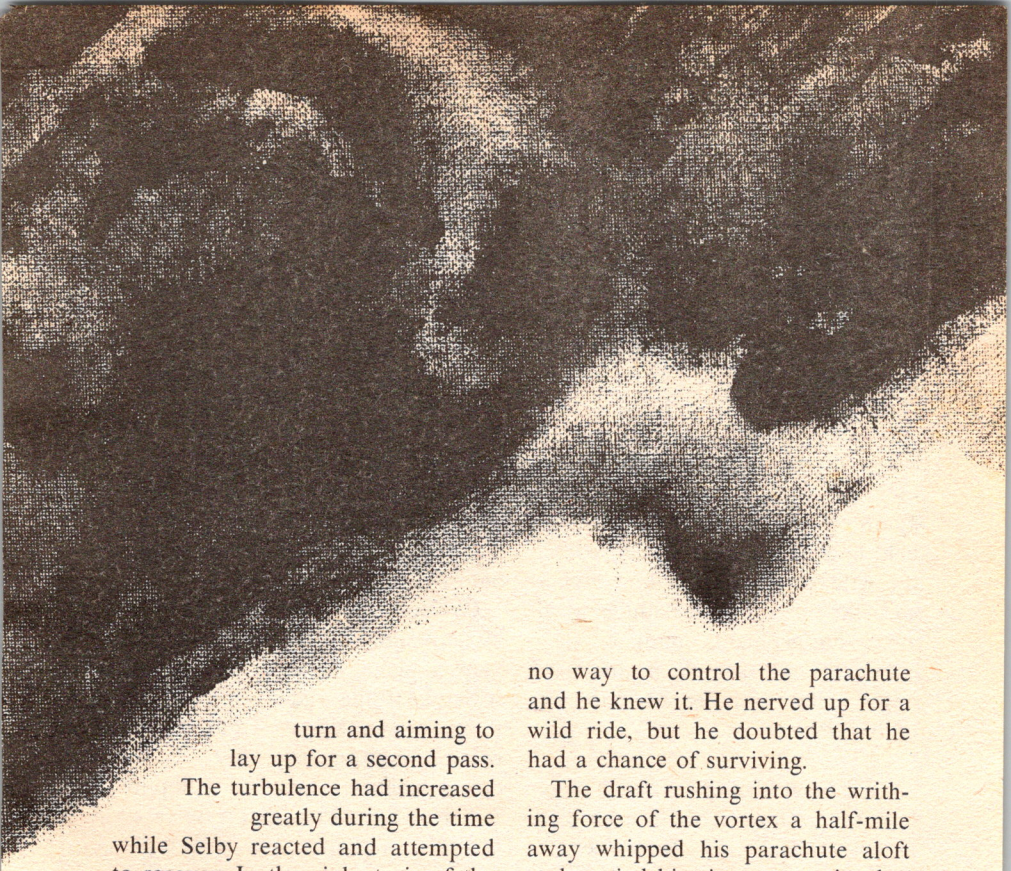


Everything went smoothly in the scramble and chase phases of the mission. It was the kind of textbook perfection that made Dan Hammer uneasy. He neither liked nor trusted the easy perfection of "school solutions." In real life they could turn treacherous.

Selby began his bomb run and bored in on the target at five hundred and ninety knots. He flashed across the I.P. and punched the autopilot for "attack." Nothing happened. In the two seconds it took him to react, recognize the trouble, and override the controls, the target was a third of a mile closer.

"Abort! Abort!" screamed Selby. He shouted into the open radio channel and worked the controls to recover his plane at the same time. "Egghead-Leader! Abort! Abort! New approach!"

He threw the Phantom into a hard 5g bank to starboard, pulling to one side of the tornado in a tight



turn and aiming to lay up for a second pass. The turbulence had increased greatly during the time while Selby reacted and attempted to recover. In the violent air of the storm, the screaming F-4J hit an eddy-gust going the other direction. The effect was much the same as flying into a rock wall at Mach 1. The Phantom folded her wings like a grotesquely stricken bird for just a second before they ripped completely free of the fuselage.

Selby had time to radio "Mayday! Mayday!" as he savagely punched the ejection button.

His Skysail chute blossomed in the tornado's wake at fourteen hundred feet, going up instead of down. Selby was helpless. He had no way to control the parachute and he knew it. He nerved up for a wild ride, but he doubted that he had a chance of surviving.

The draft rushing into the writhing force of the vortex a half-mile away whipped his parachute aloft and carried him in a narrowing helix that drew toward the vertical wall of the funnel cloud. As he swung in close, midway between earth and overcast, the howling wind of the cloud snatched his chute horizontal. The acceleration was almost beyond endurance. Selby's mind calculated the g-force and the probability of blacking out. He could feel the muscles in his face pull out of shape from the centrifugal force as his bow-taut chute dragged him through a one-hundred-eighty-degree turn around the trunk of the twisting vortex

cloud. His head swam and a giant hand squeezed steadily against his chest, as if to snap his ribs to splinters. Terrifying in its vast nearness, the rushing roar of the whirlwind enveloped him.

His body mass, swinging out from the vortex, like a horizontal pendulum, strained against the chute and forced it to collapse. Selby was hurled away from the center of the storm for the time it took his canopy to reinflate. Once again, the updraft snatched and held him as the cycle was repeated, the wild wind carrying him higher each time as it dragged him inward along that agonizing spiral.

Dazed and sagging in his harness, Selby disappeared into the boiling clouds.

"Just how high it carried him or how far he traveled before he died is not certain." A solemn Vernon Graham was addressing the hastily formed Special Investigating Subcommittee led by Senator Sam Thurlow.

"As you know," Graham continued, "Selby's body was never recovered. Even his parachute disappeared without a trace. We suspect that he was lifted to very high altitude, and most probably died of anoxia. Even at a lower altitude, in those clouds he could have frozen to death within a period of minutes."

Graham paused. "I counted Selby as my friend—my good friend. This regrettable incident must never be repeated. I blame myself, in a way, for being too anxious. If I had refused to accept the over-aged and vulnerable equipment he was using, if I had been more insistent about the safety margins of the aircraft, perhaps . . ."

"Come, come, Dr. Graham," Senator Thurlow said expansively. "We are all aware, as I'm sure you are, that many things could have contributed to this tragic disaster—*other* things than simply blaming the whistle when no tune comes out of it."

Graham drew himself together. "Examination of the wreckage of Selby's plane supports the analysis readout of the radar records, *and* the CompAn Update from the direction computers. There is no doubt whatever that the autopilot failed to respond as Selby released control of the aircraft to it. The onboard computer was new equipment, and its reliability level has been established beyond doubt . . . beyond any doubt whatsoever."

Graham stared hard at Thurlow. "This tragic loss must not blind us, Senator, to what has already been proven. Tornadoes *can be killed!* That means lives and property can be saved. Only recently, we witnessed a demonstration, followed swiftly by another, of what the future can bring. We *cannot* abandon this program. We first owed it to the American people to *try.* Now, we owe it to Peter Selby to go for-

ward . . . Thank you . . ." Dr. Graham sat down in his chair.

Senator Jill Kernan was first to get the floor, and she jumped in with both feet. "May I add, gentlemen, that by carrying on this worthy task—this enormous obligation which we have the power to fulfill—we can guarantee that Peter Selby will not have died in vain. We can't simply discard the sacrifice of a man who gave his life for a program which we now know can succeed—can achieve its goal."

"Thank you, Senator Kernan," Thurlow rumbled. He was looking even more dour than was his custom. "I'm appreciative of the sincerity of your sentiments and the high humanitarianism of your motives," he said in funereal tones. "The fact remains that to this date your tornado-killing program has enjoyed only fifty-percent effectiveness, and has"—Thurlow cleared his throat huskily—"been very costly. What assurances can be given that other brave men will not follow young Lieutenant Selby into the Shades of Death—to no avail? *I* cannot in all good conscience lend support to a proposal to continue this hazardous and ill-starred project."

Jill took a deep breath and squarely faced Senator Thurlow. "Defective equipment—aircraft not able to stand up to the strain of repeated tornado-killing—comes down *directly—in a straight line*—from false economies forced on the project at its inception. Everyone in this room is aware of the source of that economy policy. Let your good conscience consider *that,* Senator.

"Defense Department records show that both Dr. Graham and Colonel Hammer filed repeated requests for better equipment, a better maintenance budget. They acted in awareness and anticipation of the problems that later arose. Their requests were shuffled around to aircraft manufacturers and civilian contractors, where some executive pooh-poohed them because he feared a slur on his company or his products. Defense has sat on its hands and done nothing. My own memos to Defense on the subject never saw the light of day. They were pigeonholed into a 'study file.' A *study file!* The time for study—the time to convene this investigation was when we could have heard *testimony* from Lieutenant Selby, not windy eulogies after he had given his life. *That* was the time to get off the dime, gentlemen. We stand here in shame, today—*all of us*—shame that fighting a giant enemy which has walked across our helpless land each year—killing and maiming, destroying homes, crops, livestock—has brought us to the low estate where we now stand. When I say *we,* I mean the Senate, the House, the Defense Department, and those of us in this room who have taken so lightly the trust of our office that we have sat idly by and traded a

young man's life for a few lousy bucks of economizing with aircraft and components.

"Personally, I am *ashamed* that I knuckled under to such shabby bargaining. If *I*—perhaps alone, perhaps with the support of a few colleagues—had howled bloody murder as soon as the facts were presented by Colonel Hammer and Dr. Graham, then Peter Selby might still be alive.

"The die is cast, gentlemen. No more back-room political deals. I intend to honor the commitments I have already made, but there will be no new compromises. While breath remains in my body, Operation Giant-Killer will not be prevented from proving that its merciful goal *can* be realized."

The die *was* cast. The fate of Giant-Killer shaped into a head-to-head showdown between animated young Senator Jill Kernan and shaggy old Senator Sam Thurlow.

The matter had gone too far to be solved, now, without blood. Jill had lost her temper. Earlier, she had made a deal with Thurlow. Thurlow would vote for Giant-Killer as a federal program if Kernan would shut down her news and publicity machinery on the subject. Both had agreed to not comment publicly on Giant-Killer. When she learned that the project had been short-changed on the equipment it needed to do its job, and then when Selby had died, Jill Kernan realized that she had been sucked in—that Thurlow *intended* Giant-Killer to fail so he could later have his own way with the concept of the program. That made Jill furious, and she fired up an oratorical blowtorch which would force the matter into the open. She intended to push and irritate until the whole thing was forced into a public hearing, hopefully before the full Armed Forces Committee.

Those who reclined at very lofty altitudes on the slopes of the political Olympus were beginning to stir, beginning to take an interest in this "little experimental program" which was churning up such a tempest.

That's what Jill wanted. She wanted the news media to start digging the dirt and scrutinize the program closely. She wanted the President, if possible, to get interested enough to study the file on Operation Giant-Killer.

"Study!" exploded Daniel Hammer. "They aim to study us to death! It would be by-god-different if we had a problem with no answer. Damn it! It's right in front of us. We've done it, and these bastards want to keep us from doing it some more; stop me from proving out Vern's theories with hard facts." He ran his hand through his salt-and-pepper graying hair as he opened the panel which concealed Jill's office bar. He had to stoop his tall frame to look inside.

A resolution had been put forward to the Armed Services Committee, under Sam Thurlow's sponsorship, to suspend the operation of Giant-Killer until thorough studies were made. Jake Tannenbaum had tacked on a rider that would allow Giant-Killer to continue its operational status while the study commission was sorting information and drawing conclusions for its recommendations. Things had looked all right until Senator Thurlow made some rather heavy slurs against the military services.

"Circus arena!" Sam Thurlow had shouted, as he wound the spring tighter on his spellbinding machinery. "Are we allowing ourselves to be *bamboozled* into providing a circus arena for peacetime hero-playing by military adventurers?"

The remark came too close after Peter Selby's death for Dan Hammer to put up with it. He demanded of the committee the right to reply, and, strangely, got it. Aided and abetted by a little cavalier steam-rolling from Senator Pogue, Hammer was allocated ten minutes of speaking time before the full committee—contrary to stentorian complaints by Thurlow.

"The business of the soldier," Hammer had said, "is life. His job is to keep peace—not make war. We are called in to finish up the dirty-work job only after you—the civilian statesmen and legislators—have decided to fight. No one despises war like the professional soldier. He *knows* there is no glory in it and no solution from it. For him, there is only blood and death in it. But, we still work for you, and we let you think you are strong, resolute people, although we know that *your* guts wouldn't amount to a thing if not backed up by *our* blood.

"Death, destruction, killing. It's true we are hardened to it, but it is no more our *business* than it is the business of a surgeon to cut human flesh and watch the blood run. His *job* is to heal the body. Our *job* is to heal society. Both of us sometimes lose our patients."

Colonel Daniel Hammer had them in the palm of his hand. Even Thurlow's fidgeting and whispering was being ignored as everyone in the caucus room hung on Dan Hammer's words.

". . . The *real* cause of Selby's death," Hammer had said, "was lack of concern, the stupid refusal to listen. Senator Thurlow thinks Selby died because of dashing recklessness by 'military adventurers.' That's not so. Peter Selby died because of *stupidity* on the part of some civilian. He could have refused to fly junk against tornadoes—after we found out that *against tornadoes it was junk.* But, he continued to fly, as did every other pilot of mine, because *he knew it was more important to get the job done."*

There was a burst of spontaneous

applause, starting with the other witnesses appearing before the committee, spreading then to the spectators, and finally drawing in even the newsmen that were present.

Sam Thurlow was livid.

Dan Hammer took his full ten minutes, speaking with a deliberate and moving eloquence.

Sam Thurlow got more livid.

The compromise had died. Giant-Killer would be shelved.

"Don't go too heavy on the righteous wrath act," Jill said evenly. "You had them—more or less—eating out of your hand, in there. If you had been able to curb your male-ego-bull-apes-slugging-it-out-on-the-field-of-honor impulse to get old Thundercheeks Thurlow all stirred up, things might have skated through. God Almighty, Dan! You can't tell a Senator to go to hell—just like that!" She snapped her fingers. "Like he was a—a—some enlisted man who rubbed you the wrong way before breakfast. And, you sure as hell can't do it on his own territory, in front of all his pals, cronies, and henchmen."

"Crap!" Hammer growled moodily. "I didn't exactly *tell* him to. Just told him I would if I were what he called *me.*" Hammer laughed, low and in the back of his throat, like a Borgia plotting some minor throat-cutting.

"Well, I'm glad *your* ribs are tickled!" Jill's voice was rising. "All it cost was getting Giant-Killer shut down. Jake Tannenbaum's amendment stood a good chance of sliding through on the coat-tails of the study resolution. It was a good compromise, and didn't involve anyone losing face. *But, no!* You had to toss a couple of raw eggs on old Thurlow's vest. He *couldn't* do anything but react, so he got it all together before the vote came. You can bet this will be one time when the wheels won't turn slowly. When Defense lays on the suspension order, it will be fired down to McConnell so fast your thick, stubborn head will swim."

Dan Hammer grunted and studied the ice cubes in his glass, as though he expected to find the answer to his dilemma engraved on one of them.

Jill dabbed at her eyes with a tissue and then blew her nose loudly. "Well, don't just stand there, you big lunk! Fix me a drink, too."

"Mmmmm," Hammer intoned as he turned back to the bar. "Jill," he began slowly, "you've got to get me an audience with the President."

She stared out the window. "Phooey! Go through channels, Hammer." She blew her nose, again. "He's got a military adviser—some dowdy old general who always asks me to dance and then marches all over my feet."

Colonel Hammer squinted and bared his teeth. "Yeah, I know," he said grudgingly, "but he never did

like me very much—exactly. I know what *he'd* say if I asked him to get me into the Oval Office. No, that won't do. I think I could sell Operation Giant-Killer to the President . . ."

"Hmph!" Jill muttered into the tissue. "You could sell contraceptives on the Vatican steps, you great, charming, stupid—"

"What?" Hammer asked.

"Nothing."

"I could sell Giant-Killer to the President if I could get about a half-hour alone with him—in some non-rigid setting, something besides an official meeting, with a desk between us—"

"And sell yourself to him, too," Jill said. "Hah!"

Hammer buffed his fingernails on the lapel of his uniform. "Why, shucks, ma'am—that done go without sayin'. Why, mah li'l ol' bourgeois charm can wrap anyone around mah li'l ol' finger. Let's see, now. I think it should be luncheon, or a brisk walk on the south lawn. Hey, how about—"

"Forget it, Dan," Jill said. She took a big swig of her drink. "Boy, it's no accident that the trade slang for 'colonel' is 'bull.' You're not going to see the President. *None of us* are going to see the President. That's just the kind of wire-pulling short-cut that Thurlow and his gang are waiting for us to try."

"Oh," he said. "I hadn't thought about that."

"Well, you haven't been fighting The Battle of Capitol Hill as long as I have. Protocol means everything at this point. We must not give old Thundercheeks any more ammunition—and certainly none that is administrative. Besides, there's the risk to be considered."

"What risk?" Hammer asked innocently.

"The President might make some slur on the military profession. You would then give him a good, sound ass-chewing and wave your fist in his face. The Secret Service would see it all, and every one of us would land in the clink for conspiracy against the personal carcass of the Commander-in-Chief. No, thank you, Colonel Hammer. No more favors for me, please. You have put my tail in a crack quite enough for one day. Forget it."

"Well!" Hammer blustered. "You were by-god-in-there clapping louder than anyone else. I don't have all that much experience as a snake-oil salesman—a damn sight less than any given *senator*—but I thought it was a rather eloquent and moving speech, what with no notes or anything—just—you know—rip-it-off-the-cuff . . ."

And, it had been. It had turned out to be a showcase for the too-often overlooked fact that a career military officer can also be an intelligent and articulate man.

"Peter Selby didn't die for nothing. He helped us prove that tornadoes can be killed with military

aircraft. And, he unfortunately also proved that we will have to have a tougher aircraft than the Phantom Two in order to get the job done safely.

"That essentially is what I'm here for—why I felt I had to speak up. When you slander our profession, Senator Thurlow, you slander Peter Selby. You slander me. And, you slander every other man who takes routinely the risk of putting his life on the line for your benefit."

Hammer had eyed his adversary. "If that makes me a 'military adventurer,' Senator Thurlow, then I would tell you to go straight to hell. Since I am not what you called me, though, I won't tell you that."

Dan Hammer looked slowly over the faces in the caucus room. "Thank you," he said, then turned and walked back up the aisle.

There had been a second's pause, a silence heavy and pungent with tension like the still air that comes before a thunderstorm. Then, Jill Kernan had begun to clap—all alone for several seconds—gradually joined by her fellow congressmen and senators until most of them were on their feet, applauding Dan Hammer.

Jill smiled and shook her head. "Oh, you great, lovable lump. No one can stay mad at you, but the damage is done, now. Of course it was a moving speech. Of course it was great. *Except* for the part where you thumbed your nose at Sam Thurlow."

Hammer glowered. "I thought that part was nicely restrained. What I *wanted* to do was step up and punch the old bastard in the teeth."

"I know the feeling well," she said quickly. "But if I punched old Thundercheeks every time I wanted to, he'd be on his seventh set of dentures and my right arm would be two inches shorter than it is."

"So," Hammer asked, "did you applaud just to make me feel good?"

"Well, I could hardly hiss and boo, could I? I mean, under the circumstances? Seriously, Dan, it was a fine speech, and a true speech. But, dammit," Jill said exasperatedly, "don't they teach you lifers *anything* about getting along with civilians? Especially civilian officials—most of whom don't know a damned thing about the aggravations *you* have to put up with every day? Isn't there a—a—some extension course on how not to rub politicians the wrong way?"

Hammer grunted and shrugged. "Yeah. We had something like that in staff college. Called—lemme see—'Command Function Cooperation with Joint Civil Authority.' Something like that, but it didn't cover congressmen—excuse *me*, ma'am—*congresspersons.*"

"Hissssssssss," Jill said. She walked to the window and stood,

with her back to Hammer, looking out at the newly-leafed trees. The lawns had snapped back from the late spring, and the tornado season was getting into full bloom. "To return to the problem at hand," she said as she thoughtfully rubbed the tip of her prominent nose, "we'll have to wait for things to quiet down some. I can crowd some people, I can manipulate—I *can* even talk to the President about it. But, *not* till the wave of reaction pressure has gotten well past us."

"Wait?" Hammer shouted. "The tornadoes aren't going to wait! If the President could see what *I* see—what *you* see—another summer of carnage across the country—*he* wouldn't wait! He could override this 'study commission,' this *joke* of a decision that Thurlow has flim-flammed together. Selby proved what *I* need to know about tornado-killing."

"I'm convinced, too, Dan," she said. "There *is* a way to get the President's attention in a hurry, now that enough furor has whipped up to make him aware of Operation Giant-Killer"—she paused and turned toward Hammer—"if you're willing to take a chance with the old equipment. I believe it's called insubordination." Jill cocked her head at him with a quizzical expression.

Hammer backed away, as though her words were an enemy strafing run. "Oh, no! Oh, no you don't! No, you *don't!* I stuck my neck out for you, laid it on the line, and attracted all kinds of disreputable attention to myself inside the Air Force . . ." Hammer's eyes were wide with caution. "Oh, no. All I have to do is sit still and be a good boy, now. They'll fold up Giant-Killer, mothball the 918th's equipment, and *study* everything. I'll go off to a nice little wing commander's job, somewhere. I'll make brigadier. It'll be just like this whole mess never happened. I won't have any lady flying officers. I won't get roped into saying stupid things to powerful people with whom I have no business playing games." He stopped for breath. "And, I won't have any lady senators shooting at me."

Jill narrowed her eyes and peered at Hammer over the top of her glass. "Very engaging, Colonel Hammer. Answer one question for me, will you?"

"Hmm? Oh, sure. What is it?"

"Am I to take it, from this latest string of charming bullshit, that you are planning to throw in the towel on Giant-Killer?"

"Oh," Hammer replied. "I thought your insubordination idea was a pretty good one. If I were young and foolish and a lieutenant again, I'd probably risk it. However, at my age and grade the commandment is, 'Thou shalt not disobey published orders.' That's a definite no-no. Senior officers who disobey straight, clear orders get RIFed or forced to retire. They

spend the balance of their days in the midst of such excitement as playing golf with the rest of the old fuds, counting the rivets in their Levi's, and worrying about their teeth. *(It won't wash unless she can be by-god-surprised, and probably furious. Maybe I'll be the same. I'll have to wing it if I decide something* can *be done. Don't want her messing in, anyway. One conspirator does not a conspiracy make.)* Anyway, honey, I've got to get back to McConnell. There's nobody watching the store. Vern won't be down for a couple of days—he's doing some plain and fancy job-shopping at NASA, just poking around, looking for a rabbit-hole to fall into. So, I want to get back to Giant-Killer before the snotty little men with the padlocks arrive. Some of my papers aren't in order, and there's some stuff that needs to be burned."

Jill was suddenly dejected. Her last chance to strike even a token blow for tornado-killing set down his empty glass and picked up his attaché case. He retrieved his hat from the coffee-table and absently buffed the silver-braid lightning bolts on its visor against his sleeve.

"Listen—uh," Hammer said awkwardly, "next time I get into Washington, this should be simmered down some. Do you think it would be all right—I mean, would there be a lot of gossip if we sort of had dinner somewhere and laughed it up at some of the hot spots?"

"No," she managed to say. "I think that would be fine."

"Well, OK, then. I'm not throwing in the towel, Jill. It's just that you're right about waiting for things to quiet down."

To the aggravation of everyone in the path of his sonic boom, Colonel Daniel Hammer broke the standing record for the Phantom II on the DC-to-Wichita run. There would be orders cut in the Pentagon, and shipped out through channels. That would take a matter of weeks, but there would also be some traffic in the form of verbals with hard copies over the T.W.X. Hard to get around, those T.W.X. interim orders. Can't get away with misunderstanding the transmission when it's typed out in front of your face. Or, can you?

What the hell, Hammer thought. *It's possible that we'll just have to take it in the shorts, anyway. I've got to have a target within twenty-four hours of setting down or the whole game is up the spout. Still, I can't pass up a chance for a grandstand play. It will draw attention and maybe force something loose.*

It was nearly dark when Hammer taxied his plane onto the maintenance apron at the area of McConnell AFB which was staked out as Giant-Killer Command. The curving shapes of the hangars were silhouetted against the evening sky like beached whales, lying very still and wondering how they came to

be on alien sand a thousand miles from the sea. The sunset still splashed extravagant color on prodigal, low-hanging clouds in the western sky. To one side of the burning sunset, a faint corona of city lights showed the location of Wichita.

Lights were on in the buildings. Dan Hammer gave the ground crew-chief a hurried thumbs-up—"Nothing wrong with the plane"—as he took off on foot, without waiting for the jolly-wagon. As the dusk deepened and the color of the sky sank further toward indigo, a full moon began to pick out shadows. It hung brightly in the clear air, like a bald eye that watched a tiny figure moving quickly across the concrete ramp as Dan Hammer trotted toward his headquarters.

Captain Stanley Lemm was the Duty Officer. He put down his copy of *Leatherneck* and watched the T.W.X. message rattle itself over the teletype. It was the one which Hammer had been trying to beat from Washington.

"Hello, Colonel Dan," Lemm said. "How's life in the big city?"

"Could be better, Stanley. The DC Fat-Boys' Club is shutting us down for 'study.' Selby getting zapped is the excuse, but there's more to it than that." Hammer stepped quickly into his office and tossed his case on the desk.

Captain Lemm unleashed a bellowing stream of profanity. As it came to a richly cadenced, drum-roll conclusion, ". . . before I've even had a chance to kill a god-damned twister, and waste all that goddamned training? I WANT TO KILL A TWISTER!"

Hammer stepped back into the orderly room. "Well, you just sit tight, son, and you may get your chance. You ain't got just exactly the best manners in the world, but, next to Selby, you're the best flyer around here. What's the weather?" Hammer waved off the question before Lemm could answer.

The teletyper had completed its message and was methodically rapping out the authentication code. "UNTIL FURTHER NOTICE THIS HQ. DD HQ FOR USAF-CONCOM BLLING . . . AUTH. 1.685.221. . . . REPLY."

Lemm stepped to the machine and flexed his fingers in preparation for sending a routine acknowledgement.

"Hold it!" Hammer said sharply. He ripped the printout from the machine and held up his hand. "Shear off for a minute. Let me read this." He patiently read through the interim order which told Giant-Killer to stand down. "Hah!" Hammer said triumphantly. "Training flights, maintenance, and exercises are still authorized until Unit Orders arrive. Hah! Send back exactly what I dictate."

Stan Lemm wore a "the old man has flipped out" look of concern as he bent over the keyboard and sent Colonel Hammer's answer.

DD HQ FOR USAFCONCOM
GIANTKILLER COM . . . 918 TEST SQUADRON JOX(DOVJ) 76566
MCCONNELL AFB
SUBJ LAST TRAS XXXXX SUBJ LAST TRANS TRAFFIC . . . AUTH. 1.685.221 . . . YOUR MSG GARBLED BIXXXLL THIS END. CAN YU POSTPONE PEND MAINT THIS STN DUTY DAY COMM XXXXXXX AFTER 0900 XXXXX DISREGARD . . . SUB TO OUR 0900 ANDOR ALT TRANSMIT RETRANSMIT OTHER COMMO METHOD . . . STORM TROUBLE WIRE ALL DAY.

GIANTKILLER COM MCCONNELL . . . AUTH 1.685.221 . . .

The machine was silent for a moment, then erupted briefly to tell the world, "SNXXXXX BATBART COM COMPUTE YR INFOR DATA WORK PUTURE XXXXXX DISREGARD . . . BATBART COM COMPUTE YR INFIR DATA PUTER WORKING . . . WKING . . . STANDBY BATBART." It was talking to another headquarters.

Hammer shook his head. "No. The goddam thing is looking too good. It'll show up on the log when they make a commo audit. Stanley, can you jimmy this thing so incoming traffic will printout gibberish?"

"Sure," Lemm replied. "If you bash one of the cams it throws the printout cycle out of phase." He smiled broadly. "I know, Colonel Dan. I've had 'radio malfunction,' too, when they were telling me to do something I didn't want to do for a while."

"So, bash one of the blasted cams while I read over the weather," Hammer said matter-of-factly as he left the orderly room.

"Sure enough. Then, you'll tell me what the hell this is all about? Sir?"

"My solemn oath," Hammer replied.

There was a front moving southeast and it would get to Omaha well before midnight. It was already raining in Des Moines. The big computer plotted the weather grid and spat out a seventy percent probability of tornado development within the next twelve hours and within the kill radius of Giant-Killer.

Hammer returned to the orderly room with an updated weather report and the computer probability analysis on tornado imminence. Lemm had disrupted the teletype printout and was putting the last cover back on the machine.

"Sir!" Captain Lemm snapped to attention and saluted with a heavy screwdriver. "We have met the enemy and he is talking funny." He shrugged his shoulders and pointed to the disabled T.W.X.

Colonel Hammer quickly outlined the current shaky status of

Operation Giant-Killer, the oblivion in which Thurlow and his faction were trying to bury the program, and the hard fact that really official orders—orders that *couldn't* be played around with—would soon come down, freezing the program and unleashing the abominable "Study Commission" on their anti-tornado station and the experimental squadron.

"So," Hammer concluded, "as long as conditions look like we might get a tornado within strike range tonight, I'm sticking out our necks just a little further. If I can pull off a night-time kill without getting myself and another plane blown away, it will put a lot of beef in the idea that Operation Giant-Killer is a strong program and deserves better than letting a bunch of goddam civilians pick it apart."

"I'm with you, Colonel Dan. This is something I can get my *teeth* into," Lemm said enthusiastically. "Uh, who's going to fly?"

"*Me,*" Hammer said. "All by myself."

"Hell-goddamm-son-of-a-bitch!" Lemm erupted. "*I* wanna fly it! I haven't had a shot at one of these goddamn things, yet!"

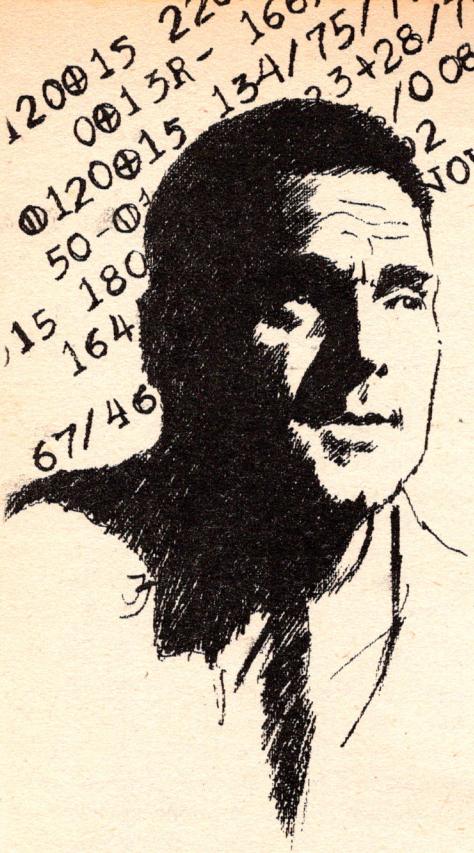
"Shut up," Hammer explained. "You are the Duty Officer from 1600 this afternoon until 1600 tomorrow afternoon. It would look just a little odd to change that, now. We can't afford to mess with rosters, assignments—anything we don't *have* to mess with. Besides, Mister rompin', stompin' jarhead, I've had a pilot killed in these planes. Don't forget *that,* Mister. I *will not* send up anyone else. Just for what I'm doing, now, they could pluck my chicken. Another Selby incident would very likely get my ass bounced right out of the Air Force."

"I hate to say it, Colonel Dan," Lemm said, "but it's going to look like hanky-panky anyway if the Inspector General gets his hooks into it. Those AFOSI guys can *really* audit the old records."

"Yeah," Hammer said reflectively. He stared at the desk top for a moment, then his head snapped up. "Hell! It's not like we were stealing whisky from the 'O' Club, Stan. Besides, it's started, now. What you see is what you get, Stanley, my boy." Hammer burned the earlier T.W.X. printout as he talked. "Do we have a plane on the line?"

"Should have," Lemm said. "I'll phone Maintenance."

"Good. I'll double-check Control to see what we have in the way of computer and radio people for attack support. When you're not using that phone, keep it off the hook. We have to prevent them from reaching us until we have a target and I'm well on my way to it—or until we abandon this entire absurd scheme. Let's get it ready to roll out, Stanley. I have a hunch that tonight is my night to get lucky. I'll stop back here after I've



been to Control. Then, I'm going over to the shed and see Mendoza. I'm going to have to depend on you to get the mission laid on. We'll shoot for a standby briefing at 1900."

Hammer was out the door before Lemm could reply, but Lemm was already on the phone, setting the pre-movement machinery into smooth motion. This was the payoff, the reason behind all the seemingly pointless make-work drills and dry runs. There were reasons—sound and solid reasons—behind the apparently picky insistence on small organizational details, the stacking of equipment in a certain way, the thousand-odd other ritual insignificances that made up the fabric and substance of a military unit. The squadron necessary to keep Jill Flight and Egghead Flight operational and ready to respond to need ran well over two hundred persons.

All the people of those sections already knew what was expected, knew their jobs and responsibilities, and had proven check-lists that could be run on zero notice. When the order came down to "standby for scramble," the entire, efficient machine swung into gear and Operation Giant-Killer could go from a complete shutdown to having planes in the air in less than an hour.

Perhaps it was the clear air that moves ahead of a storm front, and perhaps it was the tension stiffening inside Dan Hammer's body and spirit, bringing a heightened awareness and a sharpening of the senses, but the full moon seemed as close as a streetlight. The few stars visible in the bright sky blazed like polished dagger points under the moon and the clean light sparkled on the concrete runway that stretched into the distance. The black outlines of the buildings were

rimmed with intense light that danced and flickered over them and along the ground, seeming to light the grass and the trees in the open spaces from within.

The temperature was dropping along with the barometer, and a chill wind was stirring itself across the airbase.

Forty-five minutes after Dan Hammer had read the critical T.W.X. printout, prevented Stan Lemm from sending a normal acknowledgement, and set the forces in motion to deliberately disobey the *intent* of the orders from Washington—with a hopefully high probability of never getting caught at it—a lot of activity by a lot of people had come together smoothly and efficiently. Operation Giant-Killer was *legally* on a practice standby in a command-initiated graded exercise. Operation Giant-Killer was *actually* at the ready for Dan Hammer to risk his neck, alone, for the Jolly Old Cause in case a tornado developed.

Temperatures were dropping all along the weather front. A general squall line—fairly well-defined—had formed, moving southeast. At McConnell AFB it was as cold as a stainless steel toilet seat.

Computer probability for tornado development was up to ninety percent. At one hour before midnight it paid off.

Colonel Hammer was suited up, ready to go, and napping on the old leather couch in his office when Captain Lemm shook him savagely.

"Uh?" Hammer said. He was awake instantly.

"We got one!" Lemm shouted. "We got one of the bastards in strike range—an *enormous* son-of-a-bitch!"

Hammer was on his feet. "Get my plane rolled out," he said, "while I wash my face and go to the can."

Less than five minutes later, Dan Hammer emerged from the building which housed his headquarters. His helmet was under his arm. He stood for a moment in the cold, clear air and looked toward the flight line. An absurd image flitted across his mind—a knight in armor, also with a helmet under his arm, answering a dragon alert.

The tornado was ripping up the cornfields north of Winterset, Iowa. It was a big, ugly monster. The weather update and the computer projection indicated the twister was big enough to eat Des Moines, and would, unless Dan Hammer could get to it first and kill it.

If the tornado continued in its path and maintained its speed,

Hammer could get it, even in the aging Phantom II he was flying, about ten miles outside Des Moines—if nothing went wrong.

The twister itself was the center of a slower-moving vortex structure and wasn't traveling very fast, dragged back by the large area of friction with the ground, which was enlarging it dramatically—steadily transforming it into the monster predicted by the computer. Unless the tornado veered off its present heading, or unless Dan Hammer killed it with one clean shot, it *would* eat Des Moines.

The target was moving off on roughly the same heading as the direct flight path from McConnell to Des Moines, so some time could be saved by the fact that Hammer's flight path and his tornado-attack heading could be about the same azimuth. No jockeying maneuver was required to get into the attack pattern.

Hammer strained the guts of the plane as far as he dared. In less than fifteen minutes, the storm front swallowed him up, and the full moon went out like a cheap flashlight that has been dropped in the river. In less than twenty minutes he had the head of the biggest and blackest twister he had ever seen centered in the reticle of his screen.

Hammer gritted his teeth. *Well? This is what you wanted, isn't it?* His game old F-4J Phantom pulled forward like an over-the-hill hunting dog. It shuddered with a steady, tooth-jarring vibration. The turbulent clouds going past under his wings at supersonic speed were like a cobblestone street, down which he was riding a roller skate on a pine board.

Hammer steadied down to attack speed at six hundred knots and began talking to Giant-Killer Control, though the radio transmission was breaking up badly. Radar talked him in until they lost the lock on his position.

He had just inserted the attack data into his on-board computer when his radio gave a nasty little *shplook!* sound and went dead.

Dan Hammer aligned his heading and his air speed with the CompAn Update verification, and double-checked his altitude as he bored in on the target. He was braced—with his finger hovering over the button—to override manually if the autopilot didn't respond.

The red-and-green grid light blinked on as he crossed the I.P., and he punched the "Attack" button.

". . . And, of course, our big weather news tonight locally was the tornado that threatened Des Moines. That tornado ran out of gas and broke up several miles west of the city—Des Moines residents are no longer in any danger. At air-time, this station had not been able to verify if the Des Moines tornado was dissipated by the Air Force anti-tor-

nado station at Wichita, Kansas. Normal communications with McConnell Air Force Base, location of the experimental anti-tornado project, seem to be out at this time.

"Most of the Midwest is experiencing heavy rain squalls and some thunderstorms, expected to continue through the night and early morning, with the storm front moving southeasterly, accompanied by scattered light hailstorms as far south as Ottumwa.

"Meanwhile, on the national scene . . ."

Jill Kernan picked up the newspaper and read the headline one more time. She had been reading it on an average of once every five minutes for nearly two hours now.

AIR FORCE OFFICER GOES BERSERK: TRIES TO BOMB DES MOINES

She threw the paper down on top of several more which littered her coffee table. "The big damn-fool!" she snapped. She turned to the only other person in her office. "Confound it, Jake," she said to Senator Tannenbaum, "just what the hell does he think he's proved? And where are the damned news media getting all these frapping lies? Twenty-four hours, Jake! *Twenty-four lousy hours,* and there are more different stories out on this thing than there are cornfields in Kansas."

"Two questions," Tannebaum replied quietly, "require two answers. Screwball news stories and rumors *can* be corrected, but the truth never travels as fast as the original lie. Something associated with the frictionless acceleration of falsehood, I believe. You know how the media stretch a story to make it as big as possible. Secondly, you know *what* Dan Hammer has proved, Jill. Stop reacting and start thinking. He's proved that successful tornado-killing can be done not only in the bad weather attendant, but in bad weather at night, as well. It was an act of considerable courage, Jill—considering."

"All right," she said, "so he's a big, *brave* damn-fool. I'll certainly give it to you that he's got plenty of guts. But, the damned *publicity!* An official release to the media would perhaps quiet down the mess, but everyone is keeping the lid on till *someone else* moves."

"In the meantime," Tannenbaum observed, "your Operation Giant-Killer is looking, maybe, a little bit like the Air Force's funny farm?"

"Worse than that, Jake. The press is making Giant-Killer into another Watergate scandal—a comedy of stupid errors. And, this damned TV news commentator in Los Angeles—he's turning it into a slapstick revue; 'The Jill, Vern, and Danny Show, a bright, new situation comedy that bids fair to reap good ratings this summer.' "

"Well, Jill," Tannenbaum said,

"stop and think a minute. If the lid is on, officially—so—where could the leaks be coming from? The media are getting just enough information to have something silly they can—ah—play with. They must be getting it *somewhere.*"

Jill Kernan had been pacing back and forth across her office. She stopped, stock-still. *"Thurlow!"* she shouted. "Of course! Why didn't I see it before? He's leaking just enough of the nutty stuff to keep it alive for a while. Long enough to discredit Vern! Long enough to ruin Hammer's career! Long enough to make *me* a laughingstock in the Senate. It's *me* he's after! Always has been!"

Jake Tannenbaum nodded. "I'd say that's about right, but you don't need to get paranoid about it. I—"

Jill slammed her fist down on top of her desk. "He *welched* on me! We agreed privately to keep quiet—no public statements about Giant-Killer if he would vote for the program." She waved her hand. "I know, I know. An untraceable rumor isn't a public statement." She inspected the bruise beginning to show on the heel of her hand where she had slammed the desk. "He hasn't *really* broken his word, has he? He's just tried to murder Giant-Killer, that's all. He can pick up the corpse and re-animate it to suit his own purposes, later. *And,* he can keep us from getting any political mileage out of it for the party. Well, he can *try,* blast his guts, but so *help* me—"

Jake Tannebaum nodded. "So, you're finally ready to take your turn in the barrel, huh?"

Jill stopped speaking suddenly and squinted at him. "I don't get you, Jake."

"Well, Jill," he replied, "you've had other people out in front on this thing for quite a while, now. Let me just outline what's been on my mind this morning—what I've been thinking as I read these cheap headlines. This is what I really came to see you about. Now, stop and consider who stands to gain the most, who can get hurt, and how they can get hurt . . ."

Colonel Dan Hammer was promptly RIFed back to Major and drew a verbal slap on the wrist—no written reprimand would go into his service record.

RIF is an acronym for *R*eduction *I*n *F*orces. They could accurately call it *R*eduction *I*n *P*ersonnel, but "RIP" would be a bit *too* accurate. The RIF is a simple method of dumping "redundant" officers from active service without complicated legal action.

It worked the same on Dan Hammer. He retained the rank of full Colonel as an Air Force Reserve Officer, but his active duty grade was reduced to Major. A troublesome officer—and Dan Hammer had certainly stirred up trouble—could "have his teeth pulled" when there was no *real* evi-

dence that would justify the convening of a court-martial.

Senators Kernan and Tannenbaum had talked on the morning after Dan Hammer's tornado kill. In the afternoon of the same day, Jill received a telephone call from Senator Pogue.

"How y'all," Senator Pogue drawled good-humoredly. "Ah'm over here, a-settin' in the Oval Office, and jawin' with th' President. At least that's what ah call it, though ah reckon Sam Thurlow would say ah was peddlin' influence. Now, th' President wants to talk to a couple o' points about yo'r press appearance. Y'all *are* plannin' a press statement, ain't you?"

"Why, ah—that is—*yes.*" Jill finally managed to get out the word. *"(How in hell did* he *know? I guess I've still got a couple of things to learn in this town.)* "Yes," she repeated. "Of course; I'll be pleased to talk to the President about it, but why would he—"

"Don't you fret, none," Senator Pogue interrupted. "Y'all have drawed this down to a head-to-head billygoat match. What with things bein' like they are, an' all, th' President feels like maybe you should back off before you put too stiff a dose of medicine down th' public ear—"

Jill bristled. "Now just a minute, Senator Pogue—"

"Hold on!" Pogue grumped. "Let me finish. If you run out and jump up on a stump, it'll look like yo'r jumpin' Thurlow and his party. We'd admire t' get control o' both houses next year. Th' President is a little touchy—*as am* I, *Miz Kernan*—about public fistfights that could be interpreted as partisan"—he pronounced it *port-e-zan*—"sandbaggin'. Nobody's tryin' to muzzle you, but y'all accommodate the White House on this point, an' ah reckon there might be somethin' the White House can do t' accommodate you."

"I see," Jill answered evenly. "What kind of a deal are you talking, Senator?"

"Wellllll, now," Pogue hedged, "ah'm not holdin' up the President's hand for him. Ah get into plenty o' mah own trouble just bein' the minority leader of the Senate. He wants y'all to brief him on some points about yo'r Giant-Killer pet project."

Me? The President wants me *to brief* him *about Giant-Killer?* Jill thought. A little man on an ice-cold bobsled slid down her spine.

"He'll be on the line directly," Senator Pogue continued. "He's gettin' connected right now." Pogue put his hand over the telephone, loosely enough for Jill to clearly hear him say—presumably to the President—"She's got nothin' t' hide. Otherwise, she'd o' put us off till she got her story together."

Jill squinted against the televi-

sion lights, trying to divine Sam Thurlow's mental processes, but in this environment his face was a bland mask of good-humored honesty, locked into affable patterns by thirty years in the Senate.

So far, Jill thought, *I sense nothing of a trap or double-cross, except, of course, for the normal rapaciousness of network news commentators . . . Sitting there like three little coyotes in a Walt Disney cartoon, noisily licking their undersized canine teeth . . . they've just discovered that lambs are fun to play with, and even more fun to kill and eat.*

Thurlow's answer to the question droned on, punctuated by his hearty belly-rumble-chuckles.

Jill had quickly agreed to the President's suggestion. He had thought a flat public statement by Jill would smack too loudly of a partisan attack on Thurlow and his party. The President had, rather, felt it would seem more democratic for *both* Jill and Thurlow to air their views on Giant-Killer in the arena atmosphere of a public television broadcast in which major news figures quizzed persons prominently involved in some contemporary area of high public interest.

Giant-Killer was a major news story, and would be for as long as the media could sustain the interest of their consumers.

Jill wasn't sure this was the best way to present her side of the case on Giant-Killer, but when the President makes a "suggestion" of such a nature, one reacts—if one wishes to be a prudent and realistic person—by saying "yes, sir." The President does not phone up people—even Senators—without having given the matter at hand careful consideration.

"And, how do you feel about that, Senator Kernan?" asked Dan Brewster. "Do you agree or disagree?" Brewster headed up a Washington news bureau for a major network. Jill didn't like his teeth.

"Neither one," Jill said. She smiled her most photogenic of politician's smiles. "The facts of the statement as Senator Thurlow has put them, simply do not exist. Estimates by the National Oceanic and Atmospheric Administration show in hard dollars and cents how much destruction Giant-Killer averted. It saves more money than it costs. With proper funding and a comprehensive program, that dollar ratio can be driven even lower."

Brewster smiled. "Perhaps Senator Thurlow was referring to the death of Lieutenant Peter Selby. What does that come to in dollars and cents, Senator?"

Thurlow started to interrupt, but Jill waved him off. "An excellent point, Mr. Brewster. Lieutenant Selby was aware, at a gut level, what Giant-Killer could accomplish. He knew it could save lives, and, as the most experienced pilot

in the project, he knew that his job was dangerous. His first concern wasn't the price of his own skin—it was doing his job. If more members of Congress had been possessed of the same vision as Peter Selby, he would have been flying adequate equipment, and he would be alive today. I consider, Mr. Brewster, that your attempt to characterize Lieutenant Selby's death in terms of money is in very bad taste."

"In that context, Senator Kernan," Brewster said, "how would you characterize the actions of Senator Thurlow at the time he scuttled the original program proposed by yourself and Dr. Graham—I mean his actions to insist on a very *in*expensive anti-tornado program? Would you say Senator Thurlow was acting in the interest of the taxpayer—primarily—and that he had no concern for the safety of the flying officers in the program?"

"I would say," Jill replied, rather snappishly, "that Senator Thurlow's actions as I saw them at that time were short-sighted. I would also say that it takes a great deal of imagination to lay Lieutenant Selby's death at Senator Thurlow's doorstep."

"Are you then defending Senator Thurlow's policies with regard to the early formation of Giant-Killer?" Brewster asked.

"Certainly not!" Jill said. "I've made myself quite clear on this point in the past, Mr. Brewster. Could we move on to something new?"

"Of course, Senator," Brewster said smoothly.

Another newscaster jumped in quickly with a series of questions. It was established that Senator Thurlow *did* believe Giant-Killer was a valuable program. Representing, as he did, a "Tornado Alley" state, he could hardly take any other public position. His enthusiasm led Jill to suspect that some heavy compromise pressure had been brought to bear on him.

Brewster climbed back in the ring for another round. "What was your reaction, Senator Thurlow, when you learned that there might be an—ah—romantic relationship between Senator Kernan and Colonel Daniel Hammer?"

Whew! Jill thought.

Thurlow responded quickly. "I figured it was none of my damned business! You should know, Mr. Brewster, better than most folks, that by the time a person is a senator or a full colonel in the Armed Forces that person is adult enough to separate their private life from their public responsibilities. I don't see that there is, or should be, any cause-and-effect occurrences in that context worthy of comment."

That's interesting, Jill thought. *I wonder what* they've *got on each other, especially since it was Thurlow's office that leaked the lovebird story to begin with.*

"Since it was your resolution that

has put Operation Giant-Killer in mothballs, Senator, will you vote for its reinstatement if the study commission approves?" Brewster asked.

"Of course," Thurlow rumbled. "My position has always been one of approval in terms of the program's goals. Let me make it quite clear—for perhaps the hundredth time—that my only qualm about the project was the operation of such a regional program at the federal level. I think the anti-tornado idea visualized by Dr. Graham and put into operation by Colonel Hammer's experimental squadron may prove of considerable value. You and I have been over this ground before, and I think the American public knows how I feel on this point."

"I understand," Brewster said.

Pogue was right, Jill thought. *In this kind of public exposure Thurlow* can't *bad-mouth Giant-Killer.*

"And what of Colonel Hammer?" Brewster asked Thurlow. "What are your feelings about Colonel Hammer's insubordination case? Do you feel a court-martial would be in order, in view of Colonel Hammer's disobedience of orders?"

Jill started to interrupt, but Thurlow waved her off. "I feel," he said measuredly, "that it is not a senator's official responsibility to *meddle* in the internal affairs of the Air Force. It is my understanding that a minor communications malfunction prevented the anti-tornado station from receiving its orders to stand down until after Colonel Hammer made the flight which saved Des Moines from destruction by a large tornado. He wasn't thinking about taking the easy way out—file a memo and forget it. He was thinking about getting the job done. I, personally, have never questioned Colonel Hammer's courage, and I feel he is a most able commander. It is my opinion that there has been a certain amount of—ah—overreaction about this entire affair. You understand—let me make it quite clear—that this reflects my personal views about Colonel Hammer and is in no way an official pronouncement—either of indictment or defense."

Jill felt a sudden, warm glow, and wondered if her ears were turning red. She decided it must be the heat from the studio lights.

Dan Hammer watched the telecast appearance of Jill and Thurlow on *Face the Press* with mixed reactions and a half-smile playing over his face. He had hoped for Thurlow to get tarred and feathered, but Thurlow was treading water like mad to avoid getting in the soup with his constituents. Dan Brewster was doing such a good job of irritating them both that Jill and Thurlow had almost forgotten they were ready to cut each other's throats and take names when the interview started.

"And so," Jill was saying, "if

Colonel Hammer's bravery did no more than focus attention on the aspect of military administration as a series of paperwork factories, we should be grateful to him. *Readiness* is the purpose our Armed Forces must serve. Thank God Colonel Hammer's purpose was to save lives, rather than to *delay* quick reaction."

Hammer wasn't sure that had been his purpose, but he was enjoying the pure, spellbinding rhetoric of it all. Also, he appreciated the boost, which he hoped would help get him unfrozen.

Jill and Thurlow finished the discussion with express denials that any White House pressure had been brought to bear on either of them, urging the country to keep its eye on the doughnut, not the hole.

The President seemed a little reluctant, but he ordered the unfreezing of Operation Giant-Killer, although he refused to go further until a final report was in from the study commission.

There was a ceremony at the White House. Dan Hammer had agonized over the invitation, gritted his teeth, and attended. They awarded the Distinguished Flying Cross to Peter Selby, posthumously. There was a Presidential Proclamation that the first permanent Giant-Killer base would be named Anti-Tornado Station Selby in his honor.

Hammer had known about that. He had written the citation on Selby, himself, and he was aware that Jill Kernan had convinced the President to indulge in the more publicity-oriented naming of A-T Station Selby by executive proclamation.

What no one had told Hammer was that he had been tapped as a part of the ceremony, too. He was given the Commendation Ribbon. He had barely recovered from that surprise when the President opened a second presentation case. While his military aide read the orders aloud, the President pinned on one of Hammer's brigadier's stars as Jill Kernan attached the other one.

Daniel Hammer—General Daniel Hammer—knew it was a foolish, schoolboy kind of feeling, but somehow those silver stars, one on each shoulder, by themselves worth about five bucks, made all the hell he had been through seem worth while—worth doing all over again.

Brigadier General Daniel Hammer, boss of the Continental Anti-Tornado Command—or C.G., CATCOM, as the sign on his office door said—rumpled his salt-and-pepper graying hair as he gazed dreamily across his desk at the rear view of the perky redhead who was inspecting his "war map." On the wall-sized chart of the North American Continent were some two dozen station markers, designated by the same device that appeared

on the unit patch—a stylized sunburst superimposed on a tornado silhouette. The markers scattered around the edges of Tornado Alley like stars in a midnight sky, each with a circle around it that showed its strike radius and overlapped the kill-distance range of at least two other stations.

Jill Kernan, now the Senior Senator from California, had stopped off on her way home for the Christmas holidays. She turned away from the map and faced Hammer. "Dan," she said, "shouldn't there be at least one station in California? I always feel kind of foolish when I look at this thing and think of the work I put in for a program that has no effect whatever in my home state. It's just not *political.* It's *abnormal* for a senator to do something like that. Isn't it?"

Hammer chuckled. "I can never tell when you're being Little Miss Do-Gooder or Tough Old Ward-Heeler. It wouldn't do any good, Jill. California just doesn't have that many tornadoes. Even the standby aircraft we have at Edwards AFB is never used for anything but pitch-bombing practice."

"*That's* a very odd comment to be coming from a general," she retorted. "Don't they *have* to give you another star when the number of people in your command exceeds umpty-thousand—or something?"

"No," Hammer replied. "It's all in fitness reports and retention boards. Where I am, now, they give me a complete going-over once a year—physical, flying proficiency, records, maintenance, equipment, and you-think-of-it-they-already-have. If I pass on all counts they certify me 'qualified for promotion.' The first time I get passed over on one of those, they hand me the fat gold watch and the one-way ticket out to pasture."

"Oh," she said in a very small voice.

"I'm not one of your empire-builders, anyway, Jill. Can't get comfortable flying a desk. Doris Polanski is about ready to take over this chair. She's been a LTC long enough, been commanding a station for almost a year, now, and meets requirements for full colonel. She can handle it, I'm sure—sure enough to endorse the promotion forward. I'd like to see her get one star while she still has some of her youthful good looks and vigor left.

"You know, *I'd* like to get out and start a little bush-flying service of my very own—something to putter with that would keep me out of a damned swivel-chair." He struck the chair arm loudly.

"So long as the job chafes you, Dan, we need you doing it. It's those officers who get super-comfortable in the saddle and start spending more time on the golf course than on the job who ought to be retired—by firm request, if necessary."

"Well," he said, "I've been thinking about getting married, again. But every time that idea gets to preying on my mind, I just want to have another drink and think about it some more. On the other hand, I really enjoy talking to you, these days—more so than when this scheme started to hatch out. Then, every time you opened your mouth, I wanted to put my boot in it."

She came over and sat on the corner of his desk. "Well, don't get the wrong idea, but here's food for thought. Now that Giant-Killer has proved itself in full operation, there are a lot more possibilities. Why, do you know that hailstorms cause three hundred million dollars' worth of crop damage annually? Did you know that they can be broken up with pinpoint cloud-seeding by aircraft? Of course, it's fairly dangerous dirty-weather flying, but it requires a human judgment factor to get the job done just right. And think about forest fires—why, dropping fire retardants is made-to-order work for a good hedge-hopper ground support pilot. Do you know they have just as many tornadoes in central Russia as we do in the United States? The situation fairly cries out for an international cooperative program that would utilize what we've already established with this little old operation, here . . ."

"Hold it!" Dan Hammer leaped to his feet. "You've already *had* your pound of flesh from me!"

"Well," she said petulantly, "I just thought I'd mention it. Did you know that Defense and State have funded a joint study program to look into the possibilities of establishing a worldwide weather control agency?"

"Good for them," Hammer retorted. "I wish them all the good luck in the world, but—"

"But, *hell!*" She smiled, suddenly and radiantly. "I've—I've submitted your name to head it up if it's approved."

General Hammer shook his head. "Listen, Jill. I don't want to hear about it. Why don't we take a little trip down to Bora Bora, just the two of us? I hear tired blood boils more quickly in the tropics. We can forget about joint study programs and just lay in the sun."

"From anyone else," she said, "that would be an indecent proposal."

"So it would seem," Hammer said. He was beginning to feel cheerful and suspected it was a fatal mistake. "My business is in its slack season right now. I've been admiring your trim fuselage and shapely undercarriage, and the tropical invitation is still open."

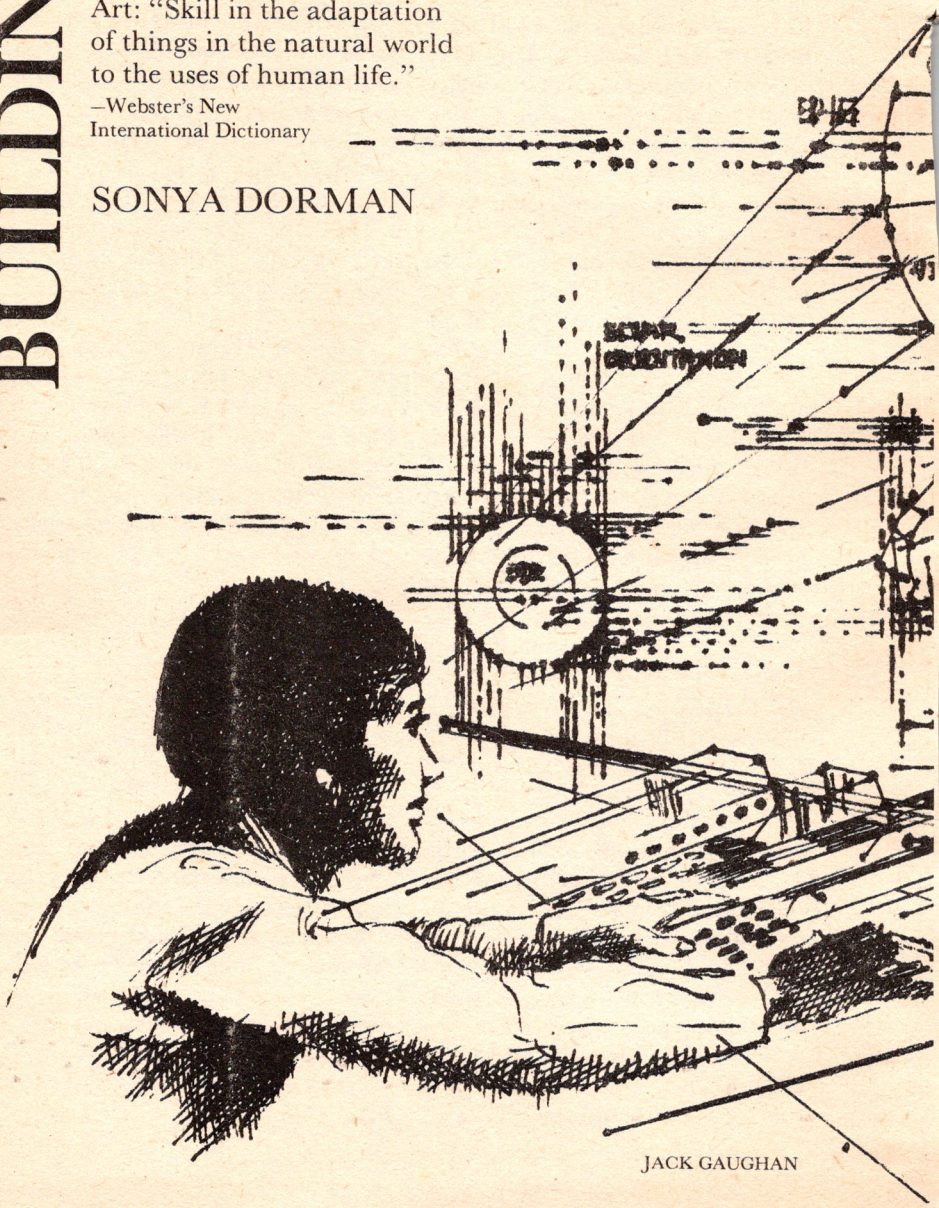
Jill snickered. "That should be far enough from the gossip columnists. I guess I'm your girl, General." She came around the desk and kissed him chastely.

Giant-killers don't have to hurry. ■

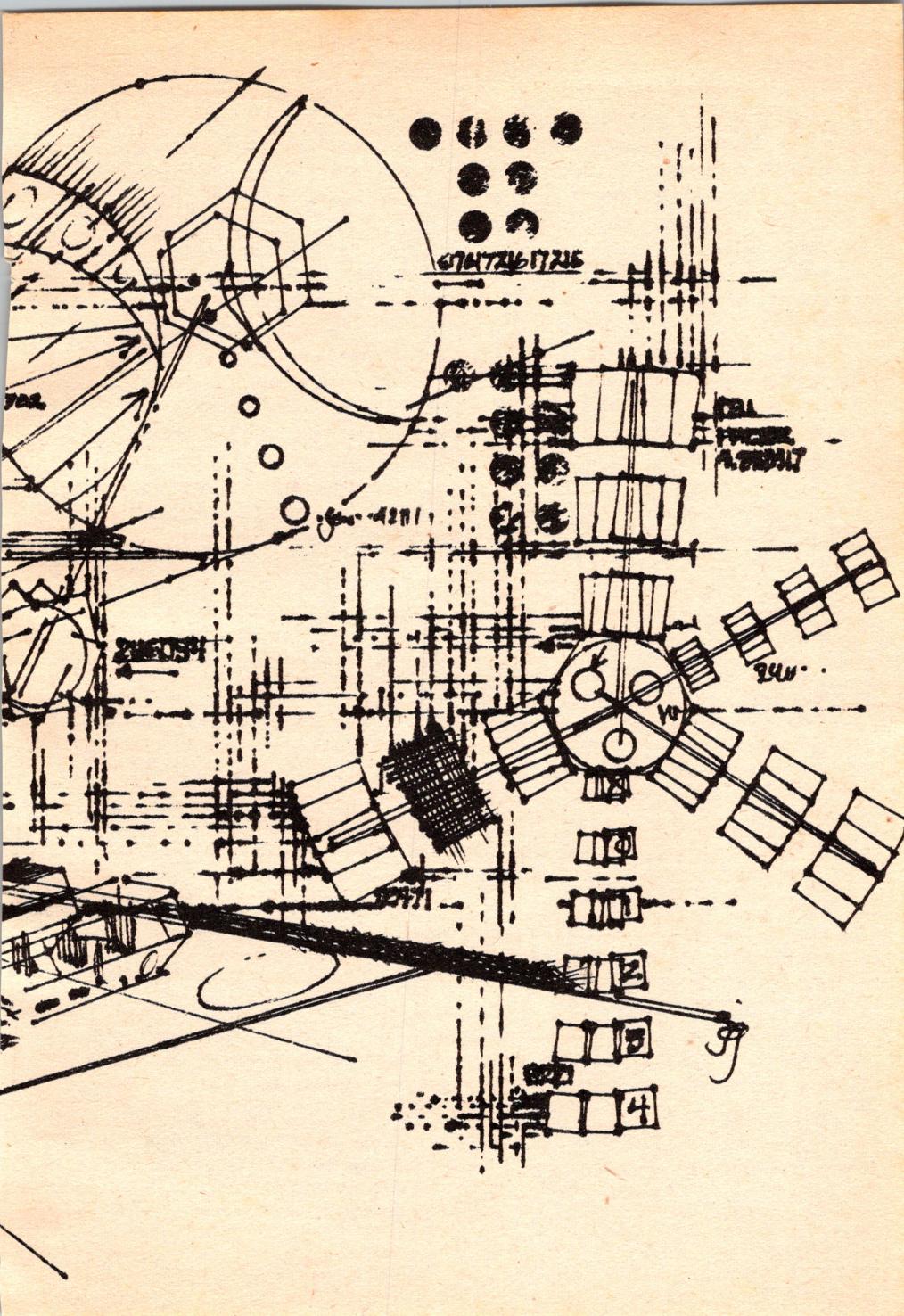
BUILDING BLOCK

Art: "Skill in the adaptation of things in the natural world to the uses of human life."
—Webster's New International Dictionary

SONYA DORMAN



JACK GAUGHAN



"Count to ten in French," Dr. Elaine Bassey told me, and I could hear my voice: "*Un, deux, trois* . . ." and feel the needle in my arm. Before closing my eyes I took a last look at the recall specialist, attractive, tall, with a strong, inquisitive face.

Closing my eyes didn't help. Dr. Bassey had said she would have trouble with me, because I was the type who wouldn't willingly surrender my "executive brain." She was so right. Owner, manager, and chief architect of Sky Castles, Incorporated, I wasn't about to give up my mind. Yet if I didn't give up a portion of it to this session, to the tape recording, I'd be broke and out of business.

"*Six, sept, huit* . . ."

In the last few years I'd designed and built half a dozen fabulous private space homes, from my own innovative plans. My mock name had become Arachne, spoken with respect, even while other space architects were doing their best to drive me out of competition.

Dr. Bassey asked me a question, and automatically I began a commercial response, indicating I hadn't yet given up enough of myself to her drug. "It's amazing," I began to spiel, "how designers with no imagination continue to use the solar power units in vanes, sticking the ugly shapes all over the buildings. What you want is a home that is your castle, a beautiful dwelling that is uniquely yours . . ."

"No," Dr. Bassey said, interrupting me. "I am Dr. Bassey, not a customer. We won't have any of this custom-built stuff. Frankly, I don't even care for the space home concept, no matter what status."

It seemed odd she was talking like that, but possibly it was in order to get through my defenses, to the lost Star Cup concept. The papers were gone. Stolen. Perhaps shredded by a competitor, or misplaced in a file, or, less likely, never in existence outside of my mind. I'd been suffering from exhaustion, followed by depression, and after my last terrific booze had put myself on vitamins and plenty of sleep, but too late: my most radical and innovative house design, along with the blueprints I swore I'd seen, was not even a memory. Or rather, it was a memory, but not reachable in ordinary conditions.

I was scared. Maybe I had lost so many neurons my brain would never be as good. Maybe I'd wind up on Pluto, another bum, working a day a month in the mines to pay for my daily bowl of soup. And no more castles in the sky. It would be worth my last credit, if a recall doctor could draw out and record the basic concept for the Star Cup. From that, I could work up the rest. Just get me the root, and I'd make the tree flower.

"Yes, that's it," Dr. Bassey said. I'd missed my own words. I now became conscious of consciousness

and began to fight the situation. Too much of the drug, and I'd be out cold; too little, and I couldn't make myself cooperate. It was a delicate business, and probably worth the enormous fee I was paying her.

"Arachne," Dr. Bassey suggested. "The web shape. The spider in the cup?"

For a glorious instant, the finished building glittered in lunar blue. I was seated at my drawing board, dead center, with the marvelous geometry spun from my brain spreading out around me. Facing the star of planetary life. Solar fire pouring energy through the lines of the web.

There was nothing else like it in the known universe; the unique beauty made it more valuable to me than anything. Quite aside from the worth in credits, it was the functional beauty of the Star Cup building concept that I wanted to retrieve. No artist can bear to lose a vision.

In a moment, it was gone.

"You're all right," Dr. Bassey said. My eyes opened to the numerals on the ceiling. An hour had passed.

"Did you get it?" I asked, sitting up and rubbing the inside of my arm where the needle had been.

Dr. Bassey was sitting at her desk, a cup of tea steaming near her left hand. The soft burr of the tape recorder was extinguished. "Feel OK?" she asked me.

"Did you get it?" I yelled impatiently, rolling off the couch to my feet. I picked up my tunic from the chair where I'd dropped it before the session began. Dr. Bassey had suggested being physically comfortable, and for me, that meant no shoes and no tunic, only the short skirt.

"I'm not at all sure," the doctor replied, leaning back in her swivel chair. There was something in her voice that was all too familiar: the assurance, the arrogance, of a person who has done you in, shafted you, fused your relays. I pressed the tunic seam shut, and looked at her through my eyelashes. I was wearing the blond ones, and they obscured far too much. Throw them out, I advised myself silently.

"You know damn well you got something," I said to Dr. Bassey, keeping a good grip on my rage, while I struggled with my incredulity. Doctors simply don't do things like this. Or do they?

"It might be worth your while to examine what I did get," she said, and took a big swig of the hot tea.

"Dr. Bassey, I told you before we began that in order to pay your fee, I took out every credit I had banked. You know I haven't worked in a year, I'm not able to work, I'm blocked. Or I wouldn't be here."

"I'm sure someone with your reputation could raise more for an emergency," she said calmly. "It might be well worth your while."

Oh you irresponsible, unprofessional fool, I thought, but not sure whether I meant it for her, or myself. I put on the dark purple shoes that matched my tunic, trying to think, but making no progress. Permanent brain damage, I assumed.

"How much?" I asked.

"Let's say, a quarter of a million?"

"Malpractice!" I shouted. "Outrageous! How do you think I'm going to raise that much? Look, Doctor, you see before you a beaten and broken woman, who not long ago worked miracles in the sky around this planet. I'm an artist. I contribute to the pyschic well-being of our species, as much if not more than you do. In effect, we both work toward the same purpose."

"Quite," she said.

"You can't do this."

"Of course I can, Norja. You told me the Star Cup concept is worth millions. I could ask you to build me one, and let it go at that, except as I told you, I don't care to revolve in space and I sincerely believe that anyone who wishes to live that way is sick. A sick escapist. A sick egotist. Draining off the sun's power before it reaches the planet at all. Living in luxury above the middle-class masses who could never in their wildest dreams afford one of those spectacular and rather ridiculous Sky Castles of yours. No, thank you. I'll take my returns in credits, the way normal, healthy people do."

The woman was obviously worse off than her patients. Yet she had been highly recommended, and in her field was as well known and successful as I was in mine.

"You'll have to give me time," I said.

"Any time," Dr. Bassey said. "I'll keep your tape in the vault. Any time to the end of the month will be fine."

"After that, I suppose you'll sell it to the highest bidder, and I can predict that will be Simons and Emory. For all I know, they bought you off the day I phoned for an appointment."

She frowned severely. "Absolutely not. I don't operate in that fashion."

"Strictly out for yourself, then."

"Certainly. Aren't you?"

Well, of course. But not by dishonorable means. I'd never cut a corner at a client's expense, and didn't intend to ever. Not that I had any clients left. The last booze had been damn near interstellar, according to gossip, anyway. Nobody seemed to understand that between the boozes, I was more lucid, talented, and productive than ten other architects put together nose to nose in a pentagon. Oh dear, no, I thought, you'd have to double the number . . . something was amiss in my mind. More vitamins? A truly tender lover? A short cruise to the moons and back? I couldn't afford the cruise, I was taking the vitamins, and a lover

would, at the moment, distract me from work. I could look forward to him after the Star Cup was completed. If I found the right one, I would, by God, build us our own Star Cup and nestle there in the center of it with him until every last credit was again gone, slowly sipping love and champagne—no, Norja, I said to myself, that's exactly what happened last time. You see where it got you.

"You have more than two weeks until the end of the month," Dr. Bassey said. "If you'll excuse me, now, I have another patient."

As I left the building, I thought how I wouldn't excuse her for anything, or forgive her, either. Of course I could report her to the Medical Corporation, but I had no proof, it was her word against that of mine, and I was broke and a scandal. The fact that I'd gone to her at all was admission of at least a temporary incompetence. Aside from not wanting to publish that admission, I felt I'd do better to handle this on my own. However, I indulged in a few revenge fantasies: how I'd use her brown left eye, frozen and ground to a distance lens, or decorate a lock panel with strands of her brunette hairs.

Home is the best place to think things out, for me, so I went directly to my four big, light rooms. I like spare surroundings, and what few stark pieces furnished my place were chosen individually. The only luxury was the huge, squashy couch that gripped you almost like warm flesh. Two seriographs on the living room wall offered tawny colors in the otherwise neutral scheme. The one object I liked better than anything else was in my study: an old fashioned artifact, quite genuine. Inside a wooden box hung on the wall there was a painted view through a worn old wooden window frame to nothing but cold blue sky. Provocative, melancholy, lonesome. Infinitely restful.

I really like my home, and everything in it, because it really is my castle, my second skin, and a reflection of part of my personality that the public never gets to see.

Lying around at home, I contemplated immediate action, another booze, a visit to friends, or one of my follow-up trips. The latter made the most sense. Every six months for five years after completing a Sky Castle home, I took an Electric Boat Cruiser out and checked with the client to make sure everything was to his taste, functioning properly, needing no adjustments. If adjustments were needed, I had them taken care of. My clients paid a lot for their homes; they got perfect service and genuine care; my reputation was not just that of an artist and craftswoman, but that of a fine, dependable business person as well. I did not build a home and then vanish. Anyone who bought a Sky Castle that I had designed knew I

was on call afterward, and that I came through on the guarantees. None of them understood what it cost me in emotional drain and surviving the pressures of emergencies, but that was OK. I didn't ask them to even think about it. You count on friends for that kind of understanding and concern; it would not be fair to ask it of clients.

Even routine checkups were better than not working at all. I went alone this trip, though often I took with me Joe Andressi, my foreman. He had such a lovely sense of humor, and easy manner, I enjoyed his company, and he enjoyed looking over a completed job. I'd once offered him a partnership, which he in his kindly manner refused, explaining how much he dreaded being desked. What he wanted for the rest of his life was access to the best building equipment and someone yelling for action. I could understand perfectly. Anyhow, this trip I felt like being alone.

The Copleys' docking carriage was warped, and that was the only repair job I found during the four-day sweep. They didn't even realize how much it needed attention, or they pretended not to, but when I said goodbye, Mrs. Copley came to the lock with me and murmured something about how Sherwood got pretty reckless with his shuttle car, and she gave me a tolerant wink, so I winked back, and we understood each other.

I gave Joe a call, and he said he'd send maintenance out right away with a new carriage frame. Business taken care of, I was left to think about Dr. Bassey. In the midst of one of these red rage bouts, I thought maybe if I went to another recall specialist—but no, what would I pay with? Personal care can't be written off as business expense. That's an artist's problem, of course. Business people get all kinds of medical coverage; action people can be insured for thousands against broken bones or ruptured spleens. A playwright or an architect, a painter or choreographer, artistically blocked and unable to produce, must pay credit on the line and in advance for any kind of medical help. It isn't fair and it ought to be changed. Some day maybe I would organize a big group and lobby the change through.

On the way home, I thought of Dr. Moons, and wondered if he was still alive. I hadn't seen him since he'd retired, to live in a modest Earthside home, his reputed millions donated to the research center named for him, The Moons Psychic Alliance Corporation. He'd been a friend of my parents and a sort of unofficial godfather to me as I grew up, but after retirement he'd become moody and reclusive, so I stopped going to visit.

My transmitter finally raised him. He didn't sound any happier to hear from me now than he had

those years ago when I'd last contacted him, but that could be my own fault, for not being more persistent.

"No," he told me, "I don't give consultations any more. I do not work. I am entitled to my peace and quiet. All I want is to be left alone with my bees and mesquite and if you have a problem there are any number of working physicians you can call on."

"But I need a friend," I told him.

"Why me?" he grumbled. "I'm an old man, and you haven't so much as called me in five years."

"Last time I called you were just plain disagreeable," I reminded him.

"I remember it, Norja. You called at a very inconvenient time." There was a long pause. He cleared his throat. Then he said, "I was younger, at that time. It's not as inconvenient right now. As a matter of fact, I'm not doing anything. The cold has put the bees into dormancy and the last batch of honey has clarified nicely. Would you like to come to dinner, Norja?"

Good old Moons, I thought. "Save me the whole comb," I said. It was an old family joke, going back to my tenth birthday when he had come to visit, bringing his usual honey jar for a gift and including in it the comb, more valuable than diamonds. It was the beeswax-based healing salve which had given him leisure to establish his Psychic Alliance Corporation.

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Of course I ate the comb in the kitchen while the grownups were having drinks before dinner, and of course I was so sick from it I couldn't look at honey again for ten years.

The transmitter said, "Bleep," or something like that, just as I switched off. Was he being funny, or was he making that sound himself? I wondered. Well, I'd find out at dinner time. And also satisfy my curiosity as to what he was doing, because certainly a man who'd been head of a corporation for many years didn't really quit business, just because he announced retirement; he simply exchanged an office desk for the easier pace of working out of his home. Moons was a good businessman, as his corporation showed more and more profits. Bees and honey must be only toys.

Dr. Moons' adobe house looked deceptively simple. I noticed lots of sagebrush growing around it, and imagined he was getting some nice honies from the sage, as well as the prized mesquite, one of the most delicate and pale honies available. His semi-wild bees were tucked away to drowse out the cold months in a row of Tudor-arched hives, in hot weather shaded by a lath roof, now open to the fine blue sky.

We had a pleasant dinner, while I opened up and explained the nature of my problem, beginning with a common enough artist's block and extending to a swindle and hold-up. He humm'd and yeah'd and nodded in his contemplative way, now and then giving me a sharp look. The dessert was Natilla with sage honey added to the cream sherry sauce, a daring innovation of his own, and entirely successful. Though I suppose a Spanish chef would be taken aback, perhaps even angry, at this departure from tradition.

When we had sipped the last cup of Café Atomico, that mixture of cognac and espresso he served to his favorite people, he asked, "Well, what is it you want? A few cc's of sodium pentothal? I'm not a recallist, but I could probably do it."

"Advice, advice," I begged. "Do it yourself or send me to someone I can pay later or suggest an alternative. For God's sake, Henry, you can see how desperate I am."

"Slowly," he said. "Softly." He poured cognac into a snifter and offered it to me. I only like cognac with coffee, so he sipped it himself.

"But the problem is, whom can you trust," Henry Moons murmured. "I don't have any pentothal here, but can get some similar stuff delivered. Why don't you stay over?"

On second thought, I poured some of the cognac into another snifter, for myself. We sat up for a while, talking about the old days, when my mother had run an independent political machine in a southern industrial sector. She'd been of considerable use to Henry Moons at one time.

The moonlight illuminated the grounds surrounding Dr. Moons' house, drawing horizontal shadows at the edge of every gully and dip, throwing down a network of black lace shadow from the thorny mesquite. He lived in a stony, somewhat hilly area, for the sake of the variety, he said.

As I went toward the guest room, I said to Dr. Moons, "It's hell, when I'm not working."

He chuckled in his dry way. "Yes, I know. I'll see what I can do."

I went to bed, planning to dream of the Star Cup, but all night I was engaged in archaic activities like galloping a horse over the desert, and it was a wonder I woke re-

freshed. After breakfast we went through what he called The Pantry, a windowless, temperature-controlled room where his honies were worked and stored, to the big, sunny den at the other side of the house.

"I don't like using sodium pentothal," he said. "I've had my own mixture made up."

"That's just what Dr. Bassey said. It seems as if no one uses the pentothal any more."

"There's much better stuff for recall on the market. Take off your shoes, Norja. Lie down. Relax. Do some deep breathing. Relax."

He put on a show of mumbling and puttering, exactly as he used to do when I was a child and in an uproar over something. It was awfully soothing. The pitch of his voice dropped lower and lower, it became a dreamlike grumble; by the time he swabbed my arm and inserted the needle, I was in a drowsy, confidential state.

"Count to ten in German," Henry Moons said.

"*Ein, zwei* . . ." I began, closing my eyes against the sunshine and trying to focus on the Star Cup blueprints.

"Now," he said, and a long pause followed. Then some intricate nonsense. "No, no, Norja, you're going under," he said. I became conscious that I was losing consciousness of what was happening. I was going back to sleep. I trusted him entirely too much, that was the trouble. It was like being back in the cradle, totally assured of everything. If I'd gone to a stranger, the sharp edge of alertness, of being on guard, would have kept me in the proper condition. His voice went on, and my voice replied, though I didn't understand what either of us said. When a blueprint came to my mind's eye, it was squinty and streaked with bright sunshine. Whatever I said fell from my lips like drops of Henry Moons' special honey, ever so slow and sweet, tumbling down a drop at a time, and melting off into the distances of desert, or space.

The sound of my own snoring brought me to. "Henry, did I sleep?" I asked, sitting up. I was alone in the room. He'd left me a note at the foot of the couch: "Norja, I'm in The Pantry and do not wish to be disturbed until noon. Make yourself comfortable. We'll talk at lunch. Uncle Henry."

Uncle Henry, indeed, I thought. He may have all the time in the world, but I can't just lie around here while he extracts honey from the comb—well, but I would have to. I took a bee-keeping journal from his desk and curled up on the couch with it. The time passed like dust drifting down; I alternated between hope and dreary boredom. At one moment I was sure he'd gotten the plans from me and by lunch time I'd be back in business; the next moment I was convinced

it was a waste of time and I might as well forget my life's work.

"Lunch," Henry Moons said, coming to the door. I went back through The Pantry after him, and emerged into the larger part of the house where beer and sandwiches waited on trays for us.

"Did you get it?" I asked, allowing myself to hope.

"I'm not sure," Henry Moons said. He licked beer foam from his upper lip. "I'm not quite sure, but it might be worth your while to find out."

"Hey, wait," I said, putting down my untasted glass of beer. "Now hold on, Dr. Moons. That's not very funny."

"No? Norja, the concept is worth millions. I've been retired for some time, and as you know, in a moment of mad generosity I gave my money to the Psychic Alliance Corporation, in which, it is true, I still hold many shares. But there's maintenance right here—"

"I'll guarantee you five years of maintenance," I screamed.

"Thank you, but I have my own arrangements. Do try the one on rice bread, it's calves' liver with sage honey and apricots."

"I'll choke first," I replied, getting up and going to the windows, just to turn my back on him and regain some control. It's one thing to be screwed by a stranger, and quite another to be screwed by a friend of the family. Good Lord, I'd known him since I was a baby. How could he do this to me thirty years later?

"Well," I said, without turning around to face him, "there's two of you bastards now, so you'll have to hope that Simons and Emory buy from you rather than the other doctor."

"My dear Norja, I'd never do anything like that. I'd so much rather build the Star Cup myself. You know, I'm getting restless. There are four or five months at this time of the year when I have nothing serious to occupy me. If you'd like to buy the tape, I'll be able to take a trip. If you prefer me to keep the tape for my own use, I'll buy a building company."

I grabbed the honey-liver-apricot sandwich from the plate and began to savagely demolish it with my teeth. Even managed to register the flavor, exotic, agreeable, richly soothing. Just like Henry Moons himself, and all on the surface. Deep down lay ulcers, I thought. Deep lay cancer of the conscience. The world was filled with liars, thieves, sick egotists and poor traitors. I was born too late, or maybe three generations too early. There was no room for an honest business person or a dedicated artist; no place to turn for advice and trust in a society that was self-seeking, and so consumed with greed that a life-long friendship could dissolve in the temptation to accumulate a little more. I hated becoming embittered, for that would

lead me toward the same kind of behavior. But how to keep myself intact, and still survive?

"Good-bye, Dr. Moons," I said. "Thank you for some delicious food, if nothing else." And may your honies all crystallize, I thought.

I went home and brooded. Two hours later, I called Joe Andressi at one of the warehouses. "Joe, if I don't call back in two hours, will you come over here and check on me?"

"Hey, you got trouble? I'll come over now," he offered.

"Uh-uh. Just wait for my call, or call me back."

"Right. Two hours."

I took off my clothes, psychologically freeing myself from all restrictions, and lay down on my bed. Star Cup. A solar power web. Shimmering lines in space, darker than blueprints. Faces came and went, too, as well as plans, lists of construction materials, routes for work shuttles. The tape recorder wound itself around. I took another sip of Hot Bird and lay back. Somewhere in my mind the concept still existed; just because I couldn't remember it didn't mean it had vanished. Once created, it must continue to exist.

After nearly two hours, I got up, looked at the empty Hot Bird bottle, put on a robe, and rewound the tape. Then I punched the *play* button, and listened.

". . . take the empiric out of the basement and put it in a glass jar to clarify . . ." I shut the damn thing off. Of course it hadn't worked. If it had, the recall specialists would be out of business.

Wearily, I made my call to Joe, told him to go home to dinner and forget the whole thing. He lingered on the line, saying, "You sure you don't want some help? You OK? You just want a voice to lean on? A pecan butter sandwich?"

"Thanks, Joe, but I have to do this one myself."

"Yeah. Well, you can get me at home if you need me."

For a while after, I sat by the windows with the lights out, looking north toward the city. I lived in the best outer ring, twenty-three stories up. I liked to look across the lighted rings, though couldn't avoid seeing the small, dark core of the city where people were so poor they couldn't afford to pay the power rates after nine at night. There weren't as many of them these days, and they were taken for granted, one of society's nagging but insoluble problems, always with us and never considered, part of our past history. The solution, if there was one, lay in a vague future. Most of the people I knew donated time, and professional help, or credits, to alleviate the worst of the poverty; they kept hope alive with small, regular feedings of promise; they handed out reward goodies to whole families, or even went so far as to move

them out to one of the more prosperous rings, where they could have lights all night if they wanted. This created the incentive in those left behind to continue the struggle, but nicely contained and comfortably out of our sight.

For the first time, I had to consider how I'd survive, if I had to live there myself. It gave me a stunned, unreal sensation. The probability of its happening was strong enough to shrivel my gut, now that I was forced to think about it.

I'd have to move into one bleak room, cold or steamy, according to the season; dark after nine at night; surrounded by desperate, unhappy people, and no escape, no hope, no ambition. Anything would be better than that, I decided. Even, for the moment, putting aside art in favor of business, though all my life I'd tried to combine the two, and keep them balanced. Now, my thoughts were giving me a different view of my world, just as that starkly painted window inside the box on my study wall sometimes did. Perhaps most people are, at some point, faced with this choice between hunger for beauty and hunger for food and shelter.

There was absolutely no question in my mind about which had precedence. I went into my study and began to draft some rough plans, and as I did so, I realized how, like so many before me in our world's history, I might benefit other people by resolving my own immediate problem.

When the plans were sketchily finished I nearly called the banker, Elliot Green, at his home, but decided the early dawn hour would find him in a sleepy stupor. For a while I sat and contemplated my new move.

It meant stepping out, literally, like a rope dancer, without a clear idea of what the other end of the rope was attached to. It gave me the frights. Nobody can do that. No painter can stand in front of a new board, without any idea of what he's going to make, and just make it. Could he? Could I? Would it be possible, in the act of doing, to do?

Even if I had the nerve to try, without advance payment I'd run out of credits half-way through, and for whom would I be building, if I had no client? Elliot Green was my only hope.

At what might be called a decent hour of dawn, I called Joe Andressi. "How soon can we get the work shuttles operating?" I asked.

"Two days. Maybe a day and a half. You got a list of materials you want? Who's the client? Norja, you don't know how glad I'll be to get back on a job."

Not any gladder than I. "Joe, I can't give you the details now. Just get those shuttles ready to go. I'll come by with the list this afternoon."

"But I don't have the specs," Joe protested.

"You'll have the building specs by the time you really need them. Trust me."

"I do," he said. It was true. We trusted each other, and that was half the secret of our progress.

I had already abandoned the degrading notion of breaking into Dr. Bassey's office and stealing the tape. I didn't want to start in that direction, because there'd be no end to what I'd do. We were all honest once. I believe we were all honest and decent when we were born, even though that's directly contrary to contemporary mercantile theory as taught in our business schools.

Before I left home, I called Elliot Green's office for an appointment; then went over to my own office. Spectacular view through stone-colored glass; filtered, clean air. As I opened the third bank of microreels, I thought how I could keep the lights and air on all night here, as well as at home, if I cared to. Push a button, screen a file; a small gesture with one finger and the power poured in. Power and love and beauty, I'd worked for them all my life and never gotten enough. Now I was going to risk what I had, run out on that rope and dance. Irrelevant, I told myself. These artsy thoughts are the equivocations of a coward. Get rid of them, because there's work to do.

By the time I'd flown over the residential rings, over the central core of the city, and over more rings, to the other side and Elliot Green's bank, I had firmed my mind. The look on my face seemed to unnerve his secretary, he barely mumbled hello.

Elliot was aimlessly sharpening the felt pens when I went in. "Hi, there," I said, sitting in his lounge chair. "How long since you've been off this planet?"

"About five years. Why? What's to space for?" He had a kind of skinny charm, a good, sharp mind, and a swift wit that I'd always appreciated.

"How'd you like to come along with me on a new job?"

"Don't be ridiculous, Norja. I'm a solid business man, not one of you winged builders."

"You once said I was a good businesswoman. Don't you believe in crossover?"

He put the yellow pen down and started to sharpen the rouge one, doing it by hand with a little knife, to amuse himself. Fortunately, he didn't have many such affectations. "Yes, I believe in it, for those lucky enough to have it."

"Come try your luck, then, Elliot. Things have changed since you were last out there. I've built six Sky Castles. Several other firms have also built space homes. Come and take a look. There are new concepts abrewing."

"Like what?" he asked.

"Like something for the ordinary man."

He put the rouge pen down by the yellow one. "What's in it for me?"

"Fun. Thrills. A look at the contemporary world of architecture. And a chance to get your name in space."

"My name!" he snorted.

Leaning toward him, I said, "I mean literally. Your name in space, and also on the rolls of history." I told him what I hoped to achieve. At intervals, he mumbled, and once shouted, that I was crazy. But he listened.

At last, Elliot Green picked up both pens together and began to inscribe two-colored doodles on his desk slate. When he was thinking hard, his nostrils flared. I watched, intrigued, as they flared with his breath. Just like a race horse at the end of six furlongs, I thought. Beautiful, fast, worth a million, and good for nothing else, if I couldn't stir him.

He asked, "How much is this going to cost me?"

"Us. It will cost us half a million, and worth it, and you know it."

"Risky. I don't take risks like that any more."

"Not since your hair turned gray?"

His nostrils flared again, this time with resentment. "It's dyed gray. I'm told it's very becoming."

"That's a new one, for you. Come on, Elliot. Suit up and space with me for a couple of days, you've forgotten how good it feels to get out there."

His eyelids flickered as he turned his gaze down toward some invisible account or oracle on his desk. He was asking himself if it was worth it, weighing the risks, the credits, the time, against his business tradition of stability, of going slowly. Weighing the publicity against the days out of the office, the credits out of his bank. Weighing the inappropriateness of space building, the rope-dancing act, for a man of his position. He had been one hell of a companion some years ago. I was counting on the nerve not being buried too deep in brain-fat.

"Oh, Norja," he sighed. "Not more than half a million?"

"You'll never regret it," I promised.

"If we pull it off, I won't," Elliot Green said, and I was delighted to hear him already saying "we." It meant he had accepted half the responsibility. "I'm not sure it can be done, but all right, I'll back you, provided you can prove out your plans for my associates. If you can, I'll have the permits ready to cosign within three days. You can use our computer complex on the eighteenth floor."

There was a long wait before he rounded up two vice-presidents, and various other officials, for a briefing, but I was glad enough of

the time to think about such details as stress, extra facilities, and whether a nursery school should be housed above or below the older students. I had just decided that all the pre-puberty children should have free run of a certain area when the last bank official came in, looking as if his ulcer hurt terribly. He sat down as soon as the introductions were over.

I went to the computer control board and began, with one of the most difficult and newest objects to be put into the sky. The first of its kind, it was a double power-conversion core. Whether it would bear the building stress along the H-bars that connected the two single cores remained to be seen. It would be shuttled out before any other equipment and put into rotation to wait for the spools of cable, the solar panels, the space tractors.

During one pause, when I became conscious again of a room full of people, fidgety, bored, drinking coffee, talking, an attack of insecurity caught me off guard. But I told myself: none of that. This is how you make a living, remember? You run out on the rope and never mind the other end, because the rope is you, and you'll fasten it when you get there.

So, step by step, I went, and the further along I built, the more clearly the next phase came to me. The geometric patterns, ten times the size I'd ever used before. Behind me, the waiting group fell quiet; I'd gotten their attention for the moment. Me, the spider, spinning the power web. Establishing the lower bank of rooms. Watching the H-bars stand up well, taking the stress. Solar panels in a fan-light shape. Light all the time, day or night, whenever the tenant wanted. Light, heat, space, a view of the Earth, that lovely marble, at appointed times.

Later on, Joe Andressi, whom I'd called before entering the computer complex, came in and forced me to sit down and eat some food. At the same time, he tried to protect me from questions and talk that would take my mind too far away from the job. He was a great buffer, and handled the bank people with a kind of gloomy tact that earned their respect. I was grateful for the break, and the nourishment, but even so I resented the interference because it was hard to get back to work again.

The Star Cup haunted me, though much less on a full belly than an empty one, perhaps proving it a hallucination, I thought. Then, for a time, I was bewildered; I stood in front of the computer and tried deep breathing exercises. My shoulder muscles ached and I felt so dismal I thought perhaps this job couldn't be done, and I'd never persuade any of them. I heard the soft voice of one woman, a vice-president, chatting with Elliot Green about a special type of mortgage for Sky Castles.

What am I doing here? I asked myself, as thousands of others ask all the time. Suffering the common woe, feeling confused, inadequate, even desperate. I plugged away at the work without much hope, but as I watched the building grow on the plan board that stretched from wall to wall above the computer banks, a little surety came back to me.

Joe Andressi murmured, "Crazy insane fabulous," and it wasn't just to keep my spirits up, I knew he really meant it.

"Champagne all around," I muttered to him, when he was standing close to my shoulder.

"Knock that off, we have work to do," he said from the side of his mouth. But he grinned, and our eyes met for a moment, making me realize how pleased we both were with the way things were going.

"By God, she's doing it," someone said from the back of the room. There were voices, the sound of people coming in, going out. All this preliminary sweat and misery bored them, they just wanted the finished plan, and then they'd decide if it was worth the risk.

It took me another hour to run through two levels of shops, schools, and other facilities, and then to check the specs from start to finish. All done. The end of the rope attached to the beginning. And all I wanted to do was sleep for days.

They crowded around me now, Elliot Green shaking my hand, the others asking questions that Joe and I tried to answer without getting too deep into the technology of space building which would only baffle them.

"Come in day after tomorrow," Elliot said to me, as we went into the lobby. "I'll have the papers and permits ready for you to co-sign."

I wondered if fifty years from now, some clerk would look at the nonfadable ink and not recognize whose signature it was. Or would they know, fifty years from now, who I was, and what I had been able to do?

At home, I stocked up on vitamins, sleep, and decent food. Work to do! My God, how happy I was. If I'd pulled off this one, there was no end to my marvelous future, and I needn't dwell any more on the bad chance of being forced to live in the drab, powerless center of the city.

After the papers were signed, and Joe Andressi took the work crew out to the site the Federal Building Corporation had alloted us, out past the spindle castle I'd built for Jim Mac a year ago, I felt that the tough part was over. Though each time I put in a call to Joe, I suffered some anxiety. Guessing what can go wrong is usually worse than watching it actually happen. But the troubles on the job were ordinary; no one was injured; Joe's time-saving bonus credits piled up and the tenth bank

of rooms was completed. Soon, a lot of weary workers could celebrate.

I began to dream of what the opening ceremonies would be like. Of course, I'd attend them in space, with Joe and those of the crew who wanted to make the trip again. It was nice to think of Elliot Green, and perhaps Dr. Elaine Bassey, if she accepted the invitation, standing with the city mayor and watching the satellite broadcast.

I took an Electric Boat Cruiser out for the ceremony. As the Cruiser approached the huge complex, even I was dazzled. By God, it wasn't bad at all. One hundred and forty compact high-power dwellings, bigger and better than anything ever built in space before, way beyond the means and dreams of Simon and Emory. The first shuttle load of tenants from the dark city core was standing by. Joe and I shook hands in front of the main lock. With a flourish, he branded the alloy plate over the lock: THE ELLIOT GREEN HOUSING PROJECT. I cut the cable, and the first shuttle load of tenants came in.

While their shuttle docked and the house was opened for moving in and living in, I clambered over the face of the building to sign my work on the edges facing Earth: NORJA I. Elliot Green wasn't going to get all the glory. He only paid half our way, the other half was mine, and NORJA II already planned, and filed with the Space Builders Corporation.

I invited Joe and a couple of the others to ride home with me in the comparative luxury of the Electric Boat Cruiser. It was commodious, and it was fast, driven by the Electric Boat Company's reactor pile designed a century or so before to power nuclear submarines. Wonderful. From undersea to outerspace, though not as outer as I'd go to build in a few more years.

Joe and I took our shoes off and put our feet up on the empty seats in front of us. I said. "Take a couple of weeks off, or even a month. You sure did earn it on this one."

"You did, too. Only, if you don't mind my saying it, I wish you'd lay off the booze. You don't want to lose another design."

"Well, look, I can recoup, Joe. It wasn't easy, but I can do it."

He gave me a peculiar look, sharp and sideways, as if I'd said something very strange. But I thought perhaps he was just overtired, as I was.

The Cruiser swung through the southeast sector to give us another view of the housing complex. "Nice," Joe said, in a subdued voice.

"Yeah," I agreed, with satisfaction.

Then someone up front yelled, "Hey, what the hell is that out there?" and we all rushed to look out the port.

A Simons and Emory work hut, suspended between two of their standard shuttles, was swarming with activity. A cup-shaped shell was already in rotation. It was one-family size, but like no other design ever seen in the universe before.

"Gawd," Joe breathed over my shoulder. "Look at that. It's a beauty."

"It's the Star Cup," I said, swallowing knives and feeling them grate and cut inside me. "It's the real thing. The one I lost."

"You gonna lay off the stuff, now?" he demanded.

"Hell no, I'm going to celebrate. There's no future in one-family units, this sector is already overbuilt. You know how much the Housing Authority Corporation offered me for NORJA II?"

"I can guess," Joe said dryly. "You're not ready to retire, huh?"

"Retire? Never. I'm just going to move out a little further, and build a little bigger. Space is space, Joe. Plenty of room to move out the whole city core to a choice sector, and give them work, too. I'm starting light industry plans next week."

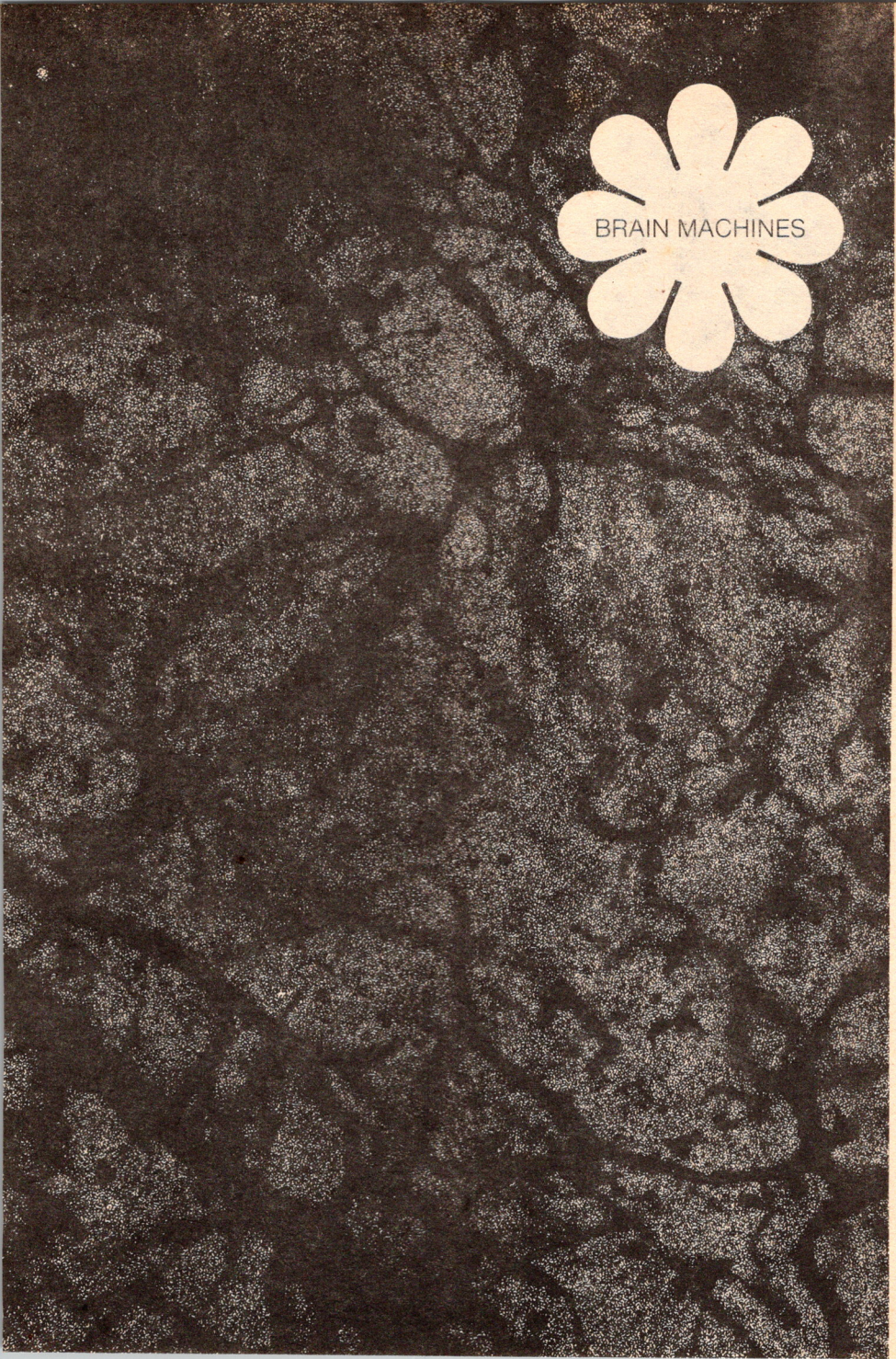
Just the same, as we swam past the Star Cup, I felt so terrible I couldn't look at it again. But the design was mine and it would operate; they could sign their names all over it but I knew who'd thought of it first, who'd lain awake nights sweating out the details. And maybe . . . some day . . . meanwhile, the offers were pouring in. So far, the best was from Curtis Titanium Flange Corporation, and I was seriously considering it.

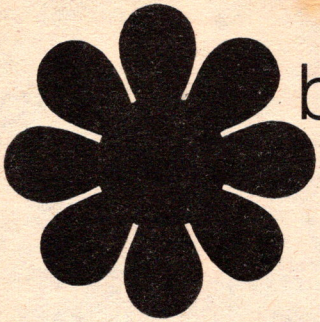
First thing I saw when I got home and pressed the power on was a big, transparent jar on my coffee table. Inside sat a complete honeycomb. Courtesy of Dr. Moons, who after all was not a sore winner. Wrenching off the lid, I dipped in two fingers, and broke off an edge of the comb. Delicious. Pure mesquite honey. Nature's own energy. I sat down, and broke off another waxy piece, and put it on my tongue to melt sweetly.

Now, if every third cell contained a solar panel, I thought, and you could stabilize rotation for that kind of shape, wouldn't it shine nicely out beyond the moon? As soon as they opened up that sector.

I uncorked a bottle of Asti Spumanti, dipped in a piece of honeycomb, and put my bare feet up on the coffee table. By next year, perhaps, I'd come up with something as good, if not better, than the Star Cup . . . meanwhile, the NORJA-CURTIS HONEYCOMB I began to take shape in my fertile mind. ■

JAN & EARL . . .
IMPORTANT
PLEASE PHONE HOME . . .
Mother


BRAIN MACHINES



brain machines

Got a problem that's too tough for you? Why not "plug in" extra brain-power?

F. N. STEIN

If you open someone's skull and peer inside, you see his brain, looking rather like an overcooked cauliflower. Under the microscope one finds a vast number of interconnected tendrils, a network of nerve cells, the so-called *neurons.* You have something like ten thousand million of them in your head; and your memory, your personality, your habits—good and bad, everything that makes you exactly you, is coded and stored in that net.

You now have appreciably fewer neurons than when you started reading this article. In the interval some have died. Neurons are never replaced (unlike most cells) so your brain is steadily getting smaller and less efficient. You are, of course, still learning but you have less to learn with—a depressing thought, especially for those of us who don't start out too well in the IQ stakes. Can modern or perhaps futuristic technology help us? Could one plug a block of neurons into one's head as one replaces a fuse or a dead lightbulb? Could one augment one's brain and double one's IQ? Make oneself immortal by gradually doing a complete replacement job?

One of the nightmares that at one time afflicted pessimistic literary men (have you noticed how few literary men are not pessimistic?) is that of the computers taking over. The quickest way to banish this nightmare used to be to go and see a computer; they blink lights in a fairly impressive way, and some of the printout looks almost intelligent, but it turns out that the lights don't do very much and the printout is invariably less intelligent than the programmer. Nowadays the air is full of the reassuring cries of literary men telling each other that computers are just mechanisms and quite safe. (It is the engineers and scientists who are causing all the trouble.)

Unfortunately, the congratulations on human supremacy are premature. Steady progress

toward machine intelligence is being made, and although only a very stupid person need feel intellectually inferior to a machine at the present time, it seems more than probable that the machines of a generation from now will be very clever indeed. Conversation with a machine might very possibly make you feel like an obtuse small boy, unable to do his sums. Important decisions such as how to run the country could well be thought far too complicated for knot-heads like us to bother about—you wouldn't let your children loose in a nuclear power station now, would you?

Now you know how the Luddites felt.

Some people have written about the intelligent self-programming computer as the next stage in evolution, and have been able to look with equanimity at the prospect of joining the dinosaurs. However, I, for one, do not propose to give in without a fight, and as a last resort would certainly try sabotage. There is, of course, a better way: if you can't beat 'em, join 'em. Or better, win them over to your side. In this case, raise your own IQ to match the smartest machine by using whatever was used to make the machine smart. So what if the aliens all have IQ's of five hundred? Go and buy a few more neurons.

Nobody knows what IQ is, but it has a great deal to do with learning. This doesn't mean "learning" in the sense of memorizing chunks of poetry. It means the business of framing "theories" to account for what has just happened and to tell you what might come next; it means changing these theories and updating them as it becomes necessary. The cognitive or "thinking" part of the brain can be described pretty well as a theorizing machine: where theories may be about tomorrow's breakfast or the effect of rain on road conditions or the price of cucumbers, and need not be at all like those consciously-held beliefs that scientists have. Reflect for a minute, on the extent to which your knowledge of the world can be expressed as a vast array of expectations of "what would happen if."

The neuron is to the brain, then, what the transistor logic block is to the computer: the basic unit. Physically, a neuron may be represented as in Fig. 1 (p. 93), a long central thread, the *axon*, with a head (the *cell body*) at one end and a lot of tails (the *dendrites*) at the other. Like the elephant, the neuron has a tail on its head: in fact a lot of tails, the *afferent* or ingoing *dendrites*. Neurons are connected tail to head, output of one set of tails going to various afferent dendrites. The place where the output from one neuron meets the input den-

drite at the head of another is called a *synapse,* or *synaptic junction.*

Nobody knows for sure how a neuron "works." Input is to the dendrites near the cell body. Pulses of a complicated electrochemical nature cross the synaptic junctions—neurons are not physically connected—and sometimes trigger the receiving neuron into sending its own pulse down the axon, the main output trunk. Here the pulse divides into several separate pulses, each traveling down a separate dendrite, without loss of amplitude. Arriving at a synapse, a pulse may or may not trigger the next neuron. Ultimately the input neurons are sensory, that is, they are fired by the outside world, photons arriving at the retina, pressure on the skin, sound at the ear. Output is to the muscles causing anything from a blink reflex to the complicated sequence of burps and coughs we call speech. What goes on in the middle, the manner in which that appalling net captures reality, is not understood.

There is a partial explanation, an incomplete theory which looks promising: one of the reasons for its appeal is that it suggests that a single neuron is a "theorizing element." A computer is built out of logic elements: AND-gates, OR-gates and inverters, which perform a logical negation. This makes them fine for doing the things computers are good at—high-speed logic, essentially. If there is one thing that's obvious to a child it's that human beings have brains that work quite differently. It takes years to train a human brain to do logic and even then it's seldom any good at it. Whatever the building blocks of the brain, they surely are not the logic units of the computer. We do not have any experience of comparable assemblies of "theorizing" units, indeed we do not even have a language in which to talk of the elements themselves: mathematicians are still in the process of inventing one. But since learning, in the sense of acquiring and modifying expectations of which way the world will jump, is such a basic feature of animal behavior, one can hope that there is a future for a model of the nervous system that sees a single neuron as a theorizing element.

The theory of a single neuron which will be described is due mainly to the psychologist Frank Rosenblatt, but many workers have contributed. (The bibliography at the end of this article is incomplete and is intended to stimulate further reading rather than distribute the honors. See Nilsson, "Learning Machines," for more complete coverage.) This model of a single neuron is sometimes called a *Perceptron,* sometimes a *Threshold Logic Unit* (mercifully abbreviated to TLU). I shall refer to it simply as a unit.

Our model neuron is almost em-

barrassingly simple. It consists of nothing more than a straight line in the plane, with an arrow sticking out of it. Also in the plane we have *data points.* These are just points which come in two distinct categories: because of a life-long fondness for the game known to the American speaking world as tic-tac-toe. I shall call them noughts and crosses. The line that is the unit has (or is) a theory about the points of the plane: if a point is on the arrow side of the line then, says the theory, it is a nought. If on the other side it is a cross. The unit in Fig. 2 (p. 94) is a theory that's consistent with the data: when the unit says a point is a nought, sure enough it is. Similarly, it is right about all three crosses.

In Fig. 3 (p. 95) a new data point has been presented to the unit. It is in fact a nought, but the unit mistakenly believes it to be a cross.

We wish to correct the unit by moving it in some way. More exactly, knowing only which point has been called, where the line is now, and the fact that the unit is in error, we want a rule for getting a new line which is right about this point. Looking at all the other points is cheating: the unit has no memory of where they are or what type they are: noughts and crosses.

There are any number of possible ways for doing this; they are called *correction procedures.* It is possible to write down formulas for some of them, but I shan't do so for two reasons. First, they are almost completely uninformative, merely lending that tone of respectable incomprehensibility that mathematics does so well, and second, the Editor won't let me. Imagine, if it makes you feel better, that the coordinates of the noughts and crosses are given, the equation of the line provided, and some formula has been decided upon for moving the line when it turns out to be wrong. Suppose the line moves to its position in Fig. 4 (p. 96).

It is now quite right about the last point called, but wrong about four others. Suppose we keep calling out these seven points at random, moving the line whenever it's wrong about a point according to the agreed formula of the correction procedure. Will it ever come to rest? Can it finish up as in Fig. 5 correctly classifying all the points?

There is a rule, a correction procedure, which moves the line every time it is wrong (in such a way that the new line depends only on the old line and the wrongly classified point) and has the property that eventually the line comes to rest, correctly classifying all the points. The proof that this is so is called the "Perceptron Convergence Theorem." It assures us that our machine will be forced to converge, to correctly classify the data points as noughts or crosses, and of course this must work for *any* set of data

points that comes in two separate bits—noughts on one side, crosses on the other.

At this point everyone except the mathematician is apt to start scratching his head. You thought you were going to get an outline explanation of how a neuron works, and here is this nut babbling about moving lines in between noughts and crosses. What, if anything, is the connection?

The mathematician comes to the rescue. (Picture him as having a high, domed forehead, pebble-lens glasses and glittering eyes.)

"Quite simple really. That was it. That is how a neuron works."

This is to be imagined as said in a tone offensively patronizing. He continues smoothly: "You see, the rest is just a matter of scaling. Instead of working in a space of two dimensions, we envisage the neuron as a hyperplane in a space of dimension, say, a thousand."

Thank you, mathematician.

The sudden increase from two to a thousand is disorienting, but the little word "say," with its suggestion of "pick a number, any number," is what hits hardest. The nonmathematician believes in three-dimensional space: he lives in it. He can swallow two dimensions as an idealization of a sheet of paper or a desk top. Four is impossible, five unspeakable, and one thousand ridiculous. If the mathematician is saying anything, he is claiming that a single neuron is a thousand-dimensional "thing," and that he keeps a stack of ten thousand million of them, all living comfortably inside a thing as big as a coconut.

There just doesn't look to be enough room.

Another thing: you are probably left with the impression that when, after colossal intellectual effort, you have made some sort of sense of this "thousand-dimensional space inside your head" business, you will still be playing thousand-dimensional tic-tac-toe and as far from understanding brains as ever.

Patience, nonmathematician. We are nearly there.

Forget about brains, neurons and squashy biological matters for a moment, and contemplate that manic line with an arrow sticking out of it, as it jumps about the plane, hopping to the right side of a point all the time, making sure that the arrow is pointing toward the noughts. In its funny little way it is an adjustable theory. It theorizes that any point on the arrow side is a nought and any point on the other side is a cross. If it turns out to be wrong, it changes its theory. Therefore, in its funny little way it learns by experience (although not about anything very interesting, to be sure). In its funny little way it generalizes—if the line correctly classifies a point as a nought then it is going to guess that any point very close to it is also a nought. (It could be wrong of course; that's life.) The thing is childishly simple,

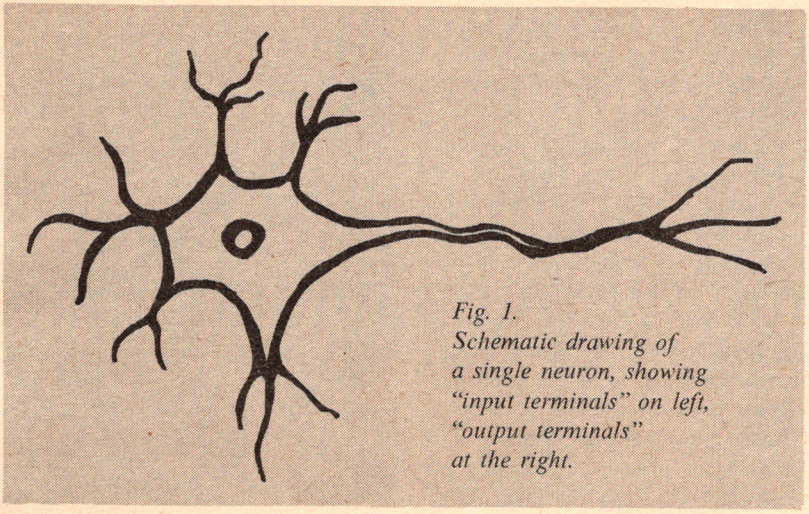


Fig. 1.
Schematic drawing of a single neuron, showing "input terminals" on left, "output terminals" at the right.

it's true; it might amuse the children to see the line jumping about like a performing flea, but is there any more to it than that?

Yes. If this theory is right, each neuron in your head is describable in just the same way as that line hopping about: the difference is that the neuron is not hopping in two spatial dimensions, it's hopping in about a thousand mathematical dimensions. Physically they're locked inside your head—there's no danger of them springing out through your ears and off down the road—but although they don't move spatially, those neurons of yours are all hopping like crazy, just the same. The mathematics is the same, and that's what counts. The additional complexity of the things that human beings theorize about (tomorrow's breakfast, say, or the price of cucumbers) and the extra complexity of their theories is taken care of by going from two to a thousand and then from one (neuron) to ten thousand million.

If the theory is right.

The nonmathematician is coming around gradually. He guesses that the "thousand-dimensional space" is a figure of speech. They aren't "real." Just a way of looking at it that these jokers have dreamed up . . .

Ha!

Of course they're "real"! Look, the reason you think of the space you live in as three-dimensional is that it takes three numbers to fix a point in it. Reckoned from the corner of the room I'm in, the end of my nose is 48 inches North, 24 inches West and 40 inches up. On my desk top the last full stop on

this page is 38 inches along and 9 inches in. Three dimensions—three numbers—two-dimensional desk top—two numbers.

A neuron has, say, a thousand input synapses. (In a "typical" cortical neuron it may be between 500 and 5,000.) Each input, at any instant, is either firing or not, so putting a "1" if it is firing and a "0" if it isn't, we can describe the world the neuron "sees" by listing a thousand numbers, one for each synapse, each number a 0 or a 1. Those thousand numbers fix a point in a space of dimension one thousand. It's true that you didn't get the numbers by measuring with a ruler, which is why they aren't spatial dimensions, but they're perfectly "real."

I remember reading, a while ago now, a story by (I think) Robert Heinlein who had a character explaining that the intricacies of the mind required the mathematics of higher dimensions. I seem to recall something about five-dimensional spaghetti, coiled in seven dimensions. He was being pretty optimistic, I'd say.

The position of the "line" that is the neuron at any instant, is determined by the concentrations of various complex molecules at the synaptic junctions. As these change, the neuron learns, and the "line" hops to a new position. If the neuron/line sees the incoming "point" (of 1,000 numbers!) as being on the "right" side of the line, the neuron

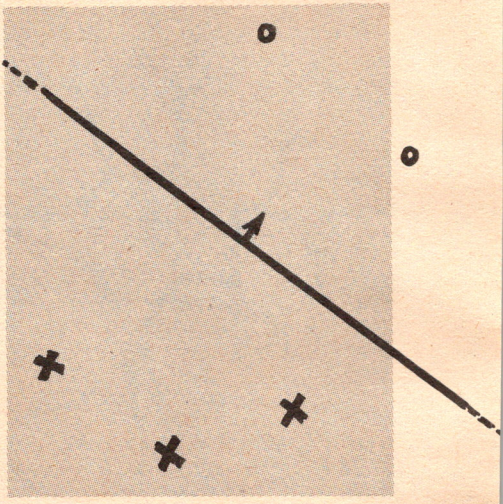


Fig. 2. The neuron-theory represented by the line "believes" a point is a nought if it lies on the arrow side of the line, a cross otherwise. This theory is correct, therefore, in its classification of all six data points.

fires: otherwise it does not. The analogy between lines and neurons is like the analogy between water waves and electromagnetic waves: the same formal language can be used to describe both. Thinking of the neuron hopping into a new position is no more fanciful than thinking of radio propagation as waves, or of electrons flowing down a wire as being, in some ways, like water flowing down a pipe.

I'll not deny that spaces of dimension a thousand take a bit of getting used to. Heinlein's five or seven begin to sound quite close to home—if your mind is boggling,

that's fine. Why else read Analog?

Take a square, six inches on a side, and rule it up into 30 equal divisions vertically; then do the same horizontally, breaking the square into 900 smaller squares. Draw a rough picture by shading in some of the squares black and leaving others white. Quite clear pictures can be obtained with this resolution, your old black and white television picture is better, but not much. Now scan your picture in the usual way, as though reading a page of print. Call out a zero for each black square and a one for each white square. When you have finished, you have called out 900 numbers (each 0 to 1). This we think of as a point in a space of dimension 900. The *whole picture,* please note, has become a single point in a high-dimensional space. A different picture "corresponds to" a different point.

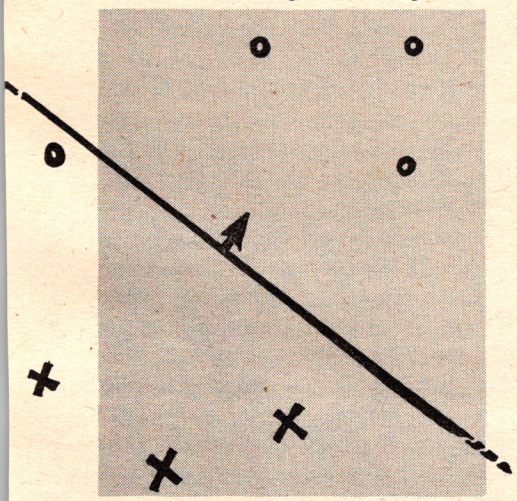


Fig. 3. The neuron-theory is, however, in error about the seventh data point, believing it to be a cross. It will have to be "corrected."

Some of these pictures might look, to a human being, like a letter *A,* others will look like other letters, still others won't look like anything very much. We take a model neuron in dimension 900 and train it to classify the pictures/points as being either *A*'s or not. When we have finished, the neuron has learned to fire when presented with an *A* (nought) and not to fire when presented with anything else (cross). We take another neuron and train it to recognize a letter *B,* and so on. The whole stack of 26 neurons can learn to recognize all the uppercase letters. Say two hundred to recognize all the usual symbols. (Incidentally, this is *not* how the brain does it!) It can be done much more efficiently than this, in fact it can be done by as few as eight neurons, if we are lucky. I leave you to figure out how. Even two hundred neurons is less intellectual power than the average cockroach, and this roach-power brain can "read" letters. If you give it a new picture, say a defaced letter, then it will "guess," and it will often guess right, too.

So just being able to tell noughts from crosses is really all you need—any number can be written in binary, any message can be coded in

noughts and ones or, for that matter, noughts and crosses. If one neuron can tell noughts from crosses, then a big enough stack of them can tell anything from any other things. From the mathematician's point of view, the oversimplification has not been too drastic: he can see how to recover something of the complexity of real brains from stringing together nets of these units, these model neurons.

Now the nerve net of the central nervous system is a highly structured assembly of billions of neurons.

What can we say about nets of units?

There are two ways of arranging units into clusters that look interesting, the committee net and the hierarchy net. We shall follow established mathematical practice by drawing pictures in the plane and forgetting about higher dimensions.

The *committee net* has some number of units arranged so that each unit "votes" on a given point, giving its opinion as to whether it's a nought or a cross. Another unit polls the committee members and calculates the majority vote. The pattern of points in Fig. 6 (p. 98), for example, is correctly classified by the committee of three members shown.

Notice that this data set could not be learned by a single unit.

The simple *hierarchy net* has a master directing two slaves. The master doesn't decide, on being presented with a point, whether it is a nought or a cross. Instead he decides which slave gets the job of deciding. The selected slave then looks at the point and gives his opinion. The data set of Fig. 7 (p. 99) can be learned by a simple hierarchy net.

We leave the reader the task of working out where to put the lines. Of course one can have hierarchies the elements of which are committees or hierarchies and so on. The complications get quite bad quite quickly.

There may be a skeptical reader who still doesn't believe in a connection between lines, noughts,

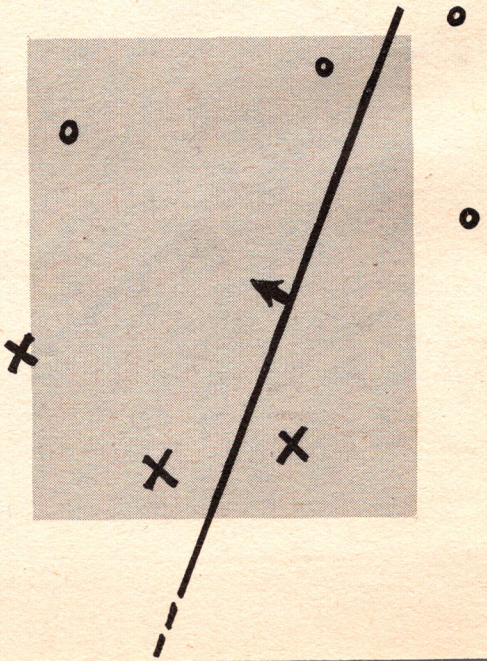


Fig. 4. The correction procedure has changed the neuron-theory so that it correctly classifies the seventh point, but now it is wrong about four others.

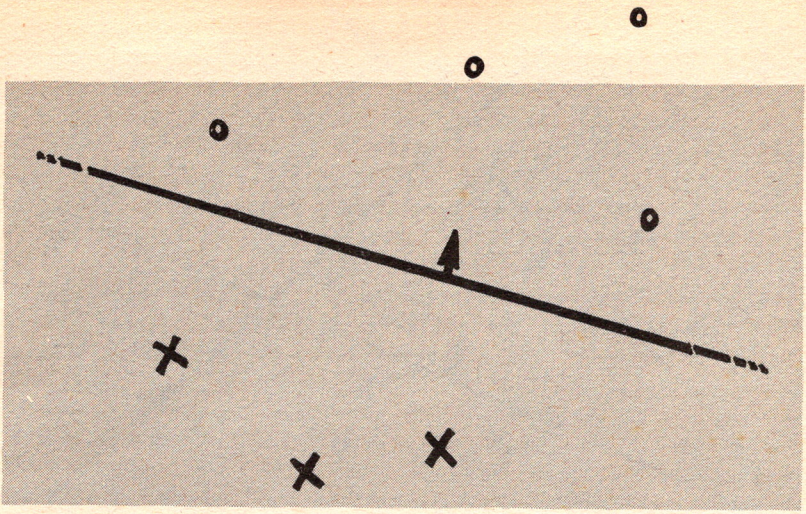


Fig. 5. The training procedure has "converged", the neuron-theory is now correct about all the data points.

crosses on the one hand and cucumbers on the other. I shall describe a computer program, written by a student of mathematics at the University of Western Australia, which simulates a "brain" of forty neurons and which learns to recognize numbers. This is still painfully simple compared with the brain of, say, a cockroach, but some interesting features can be observed.

The program works in a space of 25 dimensions; an input "point" is a string of 25 numbers which for simplicity are all 0's or 1's. To generate the "point," we draw a 5 x 5 array of boxes and shade some in so as to "draw" a single digit number—as in Fig. 8 (p. 100)—which illustrates a number, 0, picked out in this way.

Resolution is not very good but can obviously be improved by having more squares. Now we read off the squares in the usual way starting at the top left-hand corner—an unshaded square is a 0, a shaded square is a 1. So the pattern of Figure 8 becomes the sequence (0,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1, 0,0,1,0,1,1,1,1,)—a point in a space of 25 dimensions.

The "brain" consists of four committees, each committee having nine voting units, all hyperplanes in a twenty-five-dimensional space. Initially the hyperplanes are positioned at random.

Call the committees *A, B, C* and *D*. *A* votes the "point," (i.e., the pattern of Fig. 8) as being a nought or a cross, *B* does the same, and so on. We finish up with four opinions, say *O X O X* for instance, corresponding to (*A B C D*). This we interpret as a binary number—0101 which in decimal is better recognized as the number 5. This the

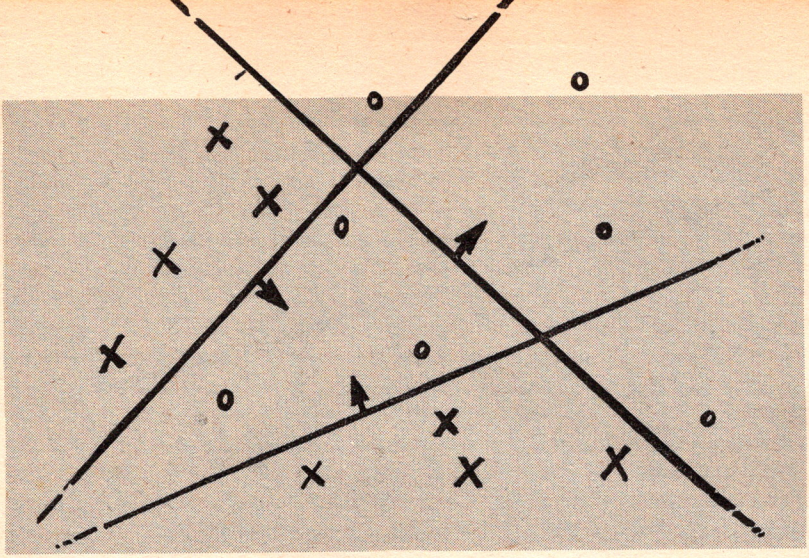


Fig. 6. A committee of three members. The majority vote of the committee correctly classifies every point, even though each committee member is wrong about some points.

machine outputs as its guess.

In this case it is badly wrong—it should have output the number 0, since that was what the pattern of Figure 8 looked like. In binary this is (0000) hence committees *B* and *D* are in error. We look at committee *B*: there are nine units of which a majority voted that the "point" of Figure 8 was a cross. Choose one at random among the committee members which thought, wrongly, that the point was a cross and correct it; i.e., move the unit (hyperplane) to the other side of the point in the space of dimension 25. Now do the same for committee *D*. Now input another "point," that is to say, another pattern of zeroes and ones; maybe the same one again. Again the machine "guesses" a number and again we correct it if it's wrong.

In time the machine learns to "read" numbers off the 5 x 5 array. Teaching the machine is, according to one student, "rather like housetraining a small puppy."

There is nothing special about the 5 x 5 array. Much better resolution can be obtained by having a 30 x 30 array: also two grades of intensities, black and white (corresponding to one and zero) are merely easier to type into the computer. Had we used a spectrum of intensities given by decimal numbers between –1 and +1 say, and a 30 x 30 array, the "brain" would have seen each *pattern* as being a single "point" in a space of dimension 900. Instead of output being a binary choice, nought or cross, the brain puts each "point" into one of ten categories; 0, 1, 2 . . . up to 9.

You can see how the mathemati-

cian's belief is vindicated: although still ridiculously simple compared with even the most primitive animal brains, this assembly of only forty "small" neurons exhibits some surprisingly complex behavior.

The following features of the machine interest psychologists:

(1) *The brain forgets.* You can train it to recognize a number 1 in any of about a dozen forms, then go on to the number 2, then 3. Now go back and you will find that it has forgotten some of the 1's. It will learn more quickly the second time, and eventually will get them all right. Now go on to 4, 5 and 6 and find that it has forgotten the 2 and 3, in some cases at least.

(2) *The memory is "hologram-like."* If some of the units are "killed," the brain still functions with only moderate impairment. In fact it can "relearn" the data into its now smaller memory. The memory of a particular digit is distributed among all forty neurons (four of which are not adaptable), which is the reason for "forgetting"—an interference phenomenon.

(3) *The brain "generalizes."* After some training has taken place and most digits have been learned, a "new" digit can be presented—say a damaged or defaced version of an already learned symbol—and the machine will guess what it should be. It guesses correctly quite often; the more training it has had the more likely it is to guess the right answer.

(4) *The brain is "plastic."* If you want, you can change the rules in the middle of training—say you en-

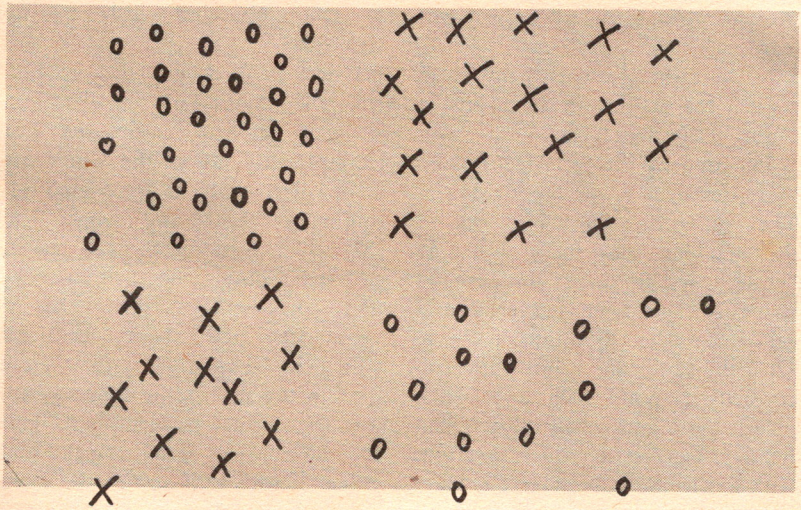


Fig. 7. A simple hierarchy net of three units, master and two slaves, can learn to correctly classify this data set.

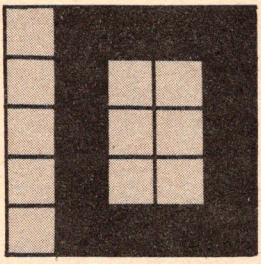


Fig. 8

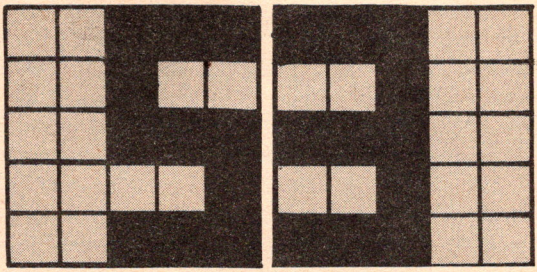


Fig. 9

Fig. 8. A single data point in a space of dimension 25, corresponding to the point: (0,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,1)
Fig. 9. Two distinct points in a space of dimension 25, one representing the digit '5', the other the digit '3'.

code the digits so that if you input a number 7, you want the brain to answer that it is a 6, if you input a 0 then you try to train the machine to answer with a 9 and so on. Providing you are consistent you can "retrain" the brain into the new ways of being right. It will lag behind at first, still mulishly giving the old answers, but in time it will learn.

An interesting experiment is to present the brain with the points of Figure 9 alternately.

The one in the left is supposed to represent a 5, on the right a 3. They differ only in two places, so the machine sees them as being "close together" in 25-dimensional space. Not surprisingly, therefore, it takes time to distinguish them. Give the brain the 5 and train it to correctly respond with a 5. Then give it the 3 and watch it guess that it's a 5! Correct it until it responds with a 3 to the 3. Now give it the 5 again and it will tell you it's a 3. It believes that they are the same, and tells you they are both whatever you trained it to see last. At length it will learn that it has been making a "category error" and will settle down, able to tell the difference between 3 and 5. By now it will probably have forgotten almost everything else, and will have to be reminded.

It is easy to modify the program which simulates this "small" brain so as to get extra complexity. For example, students at the University of Western Australia have tried adjoining a "short-term memory" to the net. This stores the last ten or so pattern-points and their category (0 to 9); when a correction has to be made, a new "theory" is found which is compatible with *all* the data in the short-term memory, not just the correct pattern-point. This has the effect of stabilizing the machine—it forgets less, and the extra

computation time is detectable as a pause. It looks very much as if the brain is "thinking," and indeed it is. For it is searching for a theory which is compatible with a body of known data—this isn't too bad a definition of thinking.

Many hours of innocent fun can be obtained from this program. You need a computer, a teletype console, and the program. The latter can be obtained by writing to Dr. M. D. Alder, Department of Mathematics, University of Western Australia, Nedlands, W.A. 6009, Australia. (Enclose 60 cents for copying and postage.) The program is about 120 lines of Fortran 4, 3K octal words memory and needs a random number generator subroutine. Otherwise it is self-explanatory on starting. It has been run on a PDP 6 belonging to the West Australian Regional Computing Centre.

More complicated nets show different "temperamental" features. The hierarchy net is a brilliant but erratic performer: it tends to "forget" large amounts of previously known information on occasion. It can be stabilized effectively with a short-term memory—a large short-term memory makes it a slow, introspective sort of beast, while a smaller one leaves it erratic. It can fail stubbornly to "understand" a distinction for a time and then suddenly make an "intuitive jump" to the right answer—only to jump away again later. Working with hierarchy nets is apt to be bad for the blood pressure—students have been found pounding on the teletype console, swearing horribly at "the dumb thing." The committee nets, by contrast, tend to be obliging but stupid. A good compromise has been found in using a committee net to learn "how a hierarchy net should learn." Undoubtedly the future will show us how to join these units up into more effective nets. It may not be too far-fetched to see some temperamental differences between human beings explained in terms of variations in their neural circuit diagrams.

What may come out of this research? Some of the possibilities were mentioned at the beginning of this article. At the moment all is highly speculative, to say the least: scientists have a powerful reluctance to say anything in public about the more extravagant possibilities in their work—they have an image of disinterested intellect to maintain. Traditionally, one simply does not expose oneself to the ridicule of outsiders by explaining why one is motivated to choose a particular line of work; hence the widespread belief that the scientist is a cold automaton.

I shall break with what seems to me a sterile and silly tradition for the purposes of this article and mention a few of the possibilities, some attractive, some repulsive, that conceivably might come to

pass. (Chances are, I'll err on the side of being too conservative.)

First, the problems of brain adjuncts would appear (if this theory is correct, a blanket assumption for the rest of the article) to be technological. We need to microminiaturize large nets of artificial neurons (physics) and find a way to hook them up to the natural supply (physiology). Augmented reasoning power would be the objective here, and would seem attainable in principle.

Second, if the memory distributes over the whole cortex, including the artificial part, total memory transference should be possible. You could buy a poet's "brain," that is, a net which had shared the experiences of a poet for some time (before being replaced by a later model, perhaps!). Learning the old-fashioned way might become almost extinct, except among the very few who enjoy it. Large sums of money might be paid to people willing to learn/experience something not already on record.

Third, by transferring all your personality, now safely stored in an artificial brain, into another body, immortality of the personality might be accomplished. Swapping parts of the artificial cortex would create "new" people, mixtures of other people, and might resolve conflicts by attaining the ultimate in interpersonal communication. (Of course, we do this already via language: you are in some sense a mixture of the ideas of the people you've talked to. In this sense, language as a medium of communication might be superseded.) You might copy your brain contents into a set of brains and produce twins, triplets, you name it, of "people" who, up to the time of twinning have had identical experiences—"were" the same people.

Fourth, by understanding how the brain "ought" to work we might be able to sharpen our ideas of malfunction or pathology. Diabetes is a clear-cut case of physiological malfunction—mental abnormalities might be classified and cured in an analogous way. New mental abnormalities might be invented—call them art-forms and grow to like them.

Fifth, the residue of what makes a man what he is might become a good deal more accessible. If you believe in the Psi-phenomena, then any start on the analysis of mind is to be welcomed, for only by studying cognitive processes in this prosaic way can any other mental attributes be clearly distinguished. (And ultimately reduced to the prosaic.) If, as some writers seem to believe, there is something distinctively human about an organic brain and the transfer to an artificial one would produce the effect of "one instrument of the orchestra slightly out of tune," then only by trying the experiment and noting the effect carefully can we hope to understand this curious phenomenon.

Sixth, even if the brain-adjunct business folds through technical difficulties, by modeling "people" on computers we may yet turn psychology into a science. Do I hear an alchemist protesting? Spin-off in the field of education, concerning which nothing is known, seems most likely. Spare-the-rodders and disciplinarians of any vintage could fight it out on machines in a few months instead of playing hob with real live people.

Finally, whatever wild dreams you spin, remember that you do it with the pale naked brain of a half-ape and that the dreams of your successors must be very different. ■

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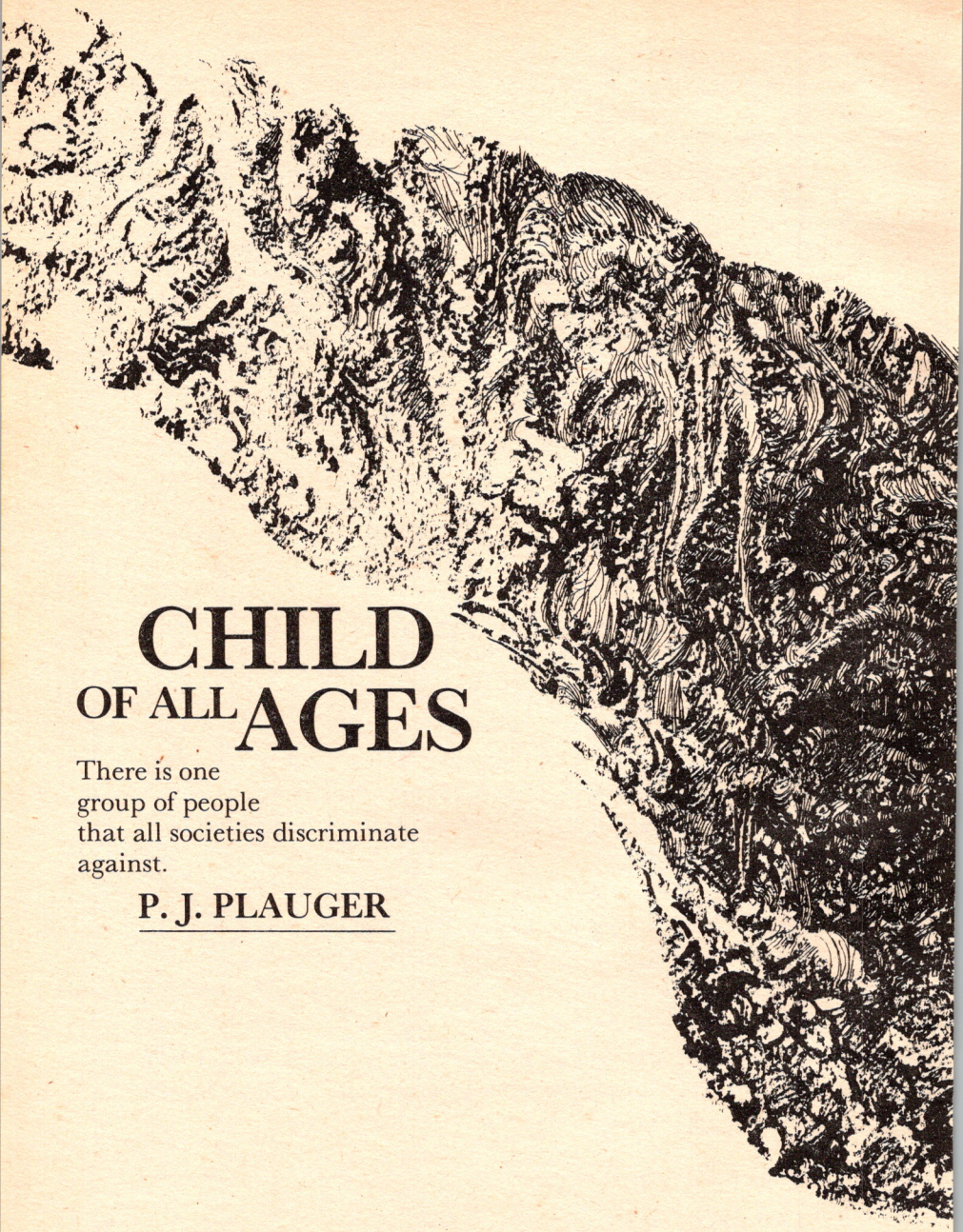
in times to come

Exactly twelve months after her first appearance, Brenda Pearce returns with a powerful lead novelette, "Crazy Oil," which brings us to the weird and dangerous surface of Venus. The cover painting, by Rick Sternbach, shows how Venus' soup-thick atmosphere creates visual distortions of the landscape.

A special feature of next month's issue will be "Debate: National Health Insurance," in which F. Paul Wilson and Alan E. Nourse, both MD's and both science fiction writers of note, slug it out verbally. The science fact article may well be a landmark, also: "The Economics of the Robot Revolution," by James S. Albus, who asks the question, "When automated factories make work obsolete, how do people make money?"



CHILD OF ALL AGES

There is one
group of people
that all societies discriminate
against.

P. J. PLAUGER

The child sat in the waiting room with her hands folded neatly on her lap. She wore a gay print dress made of one of those materials that would have quickly revealed its cheapness had it not been carefully pressed. Her matching shoes had received the same meticulous care. She sat prim and erect, no fidgeting, no scuffing of shoes against chair legs, exhibiting a patience that legions of nuns have striven, in vain, to instill in other children. This one looked as if she had done a lot of waiting.

May Foster drew back from the

JOHN SCHOENHERR

two-way mirror through which she had been studying her newest problem. She always felt a little guilty about spying on children like this before an interview, but she readily conceded to herself that it helped her handle cases better. By sizing up an interviewee in advance, she saved precious minutes of sparring and could usually gain the upper hand right at the start. Dealing with "problem" children was a no-holds-barred proposition, if you wanted to survive in the job without ulcers.

That patience could be part of her act, May thought for a moment. But no, that didn't make sense. Superb actors that they were, these kids always reserved their performances for an audience; there was no reason for the girl to suspect the special mirror on this, her first visit to Mrs. Foster's office. One of the best advantages to be gained from the mirror, in fact, was the knowledge of how the child behaved when a social worker wasn't in the room. Jekyll and Hyde looked like twins compared to the personality changes May had witnessed in fifteen years of counseling.

May stepped out of the darkened closet, turned on the room lights and returned to her desk. She scanned the folder one last time, closed it in front of her and depressed the intercom button.

"Louise, you can bring the child in now."

There was a slight delay, then the office door opened and the child stepped in. For all her preparation, May was taken aback. The girl was thin, much thinner than she looked sitting down, but not to the point of being unhealthy. Rather, it was the kind of thinness one finds in people who are still active in their nineties. Not wiry, but enduring. And those eyes.

May was one of the first Peace Corps volunteers to go into central Africa. For two years she fought famine and malnutrition with every weapon, save money, that modern technology could bring to bear. In the end it was a losing battle, because politics and tribal hatred dictated that thousands upon thousands must die the slow death of starvation. That was where she had seen eyes like that before.

Children could endure pain and hunger, forced marches, even the loss of their parents, and still recover eventually with the elasticity of youth. But when their flesh melted down to the bone, their bellies distended, then a look came into their eyes that remained ever with them for their few remaining days. It was the lesson learned much too young that the adult world was not worthy of their trust, the realization that death was a real and imminent force in their world. For ten years after, May's nightmares were haunted by children staring at her with those eyes.

Now this one stood before her

and stared into her soul with eyes that had looked too intimately upon death.

As quickly as she had been captured, May felt herself freed. The girl glanced about the room, as if checking for fire exits, took in the contents of May's desk with one quick sweep, then marched up to the visitor's chair and planted herself in it with a thump.

"My name is Melissa," she said, adding a nervous grin. "You must be Mrs. Foster." She was all little girl now, squirming the least little bit and kicking one shoe against another. The eyes shone with carefree youth.

May shook herself, slowly recovered. She thought she had seen everything before, until now. The guileless bit was perfect—Melissa looked more like a model eight-year-old than a chronic trouble-maker going on, what was it? Fourteen. *Fourteen?*

"You've been suspended from school for the third time this year, Melissa," she said with professional sternness. May turned on her best Authoritarian Glare, force three.

"Yep," the child said with no trace of contrition. The Glare faded, switched to Sympathetic Understanding.

"Do you want to tell me about it?" May asked softly.

Melissa shrugged.

"What's to say? Old Man M—uh, Mr. Morrisey and I got into an argument again in history class." She giggled. "He had to pull rank on me to win." Straight face.

"Mr. Morrisey has been teaching history for many years," May placated. "Perhaps he felt that he knows more about the subject than you do."

"Morrisey has his head wedged!" May's eyebrows skyrocketed, but the girl ignored the reproach, in her irritation. "Do you know what he was trying to palm off on the class? He was trying to say that the Industrial Revolution in England was a step backward.

"Kids working six, seven days a week in the factories, going fourteen hours at a stretch, all to earn a few pennies a week. That's all he could see! He never thought to ask *why* they did it if conditions were so bad."

"Well, why did they?" May asked reflexively. She was caught up in the child's enthusiasm.

The girl looked at her pityingly.

"Because it was the best game in town, that's why. If you didn't like the factory, you could try your hand at begging, stealing, or working on a farm. If you got caught begging or stealing in those days, they boiled you in oil. No joke. And farm work." She made a face.

"That was seven days a week of busting your tail from *before* sunup to *after* sundown. And what did you have to show for it? In a good year, you got all you could eat; in a bad year you starved. But you worked just as hard on an empty

gut as on a full one. Harder.

"At least with a factory job you had money to buy what food there was when the crops failed. That's progress, no matter how you look at it."

May thought for a moment.

"But what about all the children maimed by machinery?" she asked. "What about all the kids whose health was destroyed from breathing dust or stoking fires or not getting enough sun?"

"Ever seen a plowboy after a team of horses walked over him? Ever had sunstroke?" She snorted. "Sure those factories were bad, but everything else was *worse*. Try to tell that to Old Man Morrisey, though."

"You talk as if you were there," May said with a hint of amusement.

Flatly. "I read a lot."

May recalled herself to the business at hand.

"Even if you were right, you still could have been more tactful, you know." The girl simply glowered and hunkered down in her chair. "You've disrupted his class twice, now, and Miss Randolph's class too."

May paused, turned up Sympathetic Understanding another notch.

"I suspect your problem isn't just with school. How are things going at home?"

Melissa shrugged again. It was a very adult gesture.

"Home." Her tone eliminated every good connotation the word possessed. "'My fa—my foster father died last year. Heart attack. Bam! Mrs. Stuart still hasn't gotten over it." A pause.

"Have you?"

The girl darted a quick glance.

"Everybody dies, sooner or later." Another pause. "I wish Mr. Stuart had hung around a while longer, though. He was OK."

"And your mother?" May prodded delicately.

"My *foster* mother can't wait for me to grow up and let her off the hook. Jeez, she'd marry me off next month if the law allowed." She stirred uncomfortably. "She keeps dragging boys home to take me out."

"Do you like going out with boys?"

A calculating glance.

"Some. I mean boys are OK, but I'm not ready to settle down quite yet." A nervous laugh. "I mean I don't *hate* boys or anything. I mean I've still got lots of time for that sort of stuff when I grow up."

"You're nearly fourteen."

"I'm small for my age."

Another tack.

"Does Mrs. Stuart feed you well?"

"Sure."

"Do you make sure you eat a balanced diet?"

"Of course. Look, I'm just naturally thin, is all. Mrs. Stuart may be a pain in the neck, but she's not trying to kill me off or anything.

It's just that—" a sly smile crossed her face. "Oh, I get it."

Melissa shifted to a pedantic false baritone.

"A frequent syndrome in modern urban society is the apparently nutrition-deficient early pubescent female. Although in an economic environment that speaks against a lack of financial resources or dietary education, said subject nevertheless exhibits a seeming inability to acquire adequate sustenance for growth.

"Subject is often found in an environment lacking in one or more vital male supportive roles and, on close examination, reveals a morbid preoccupation with functional changes incident to the onset of womanhood. Dietary insufficiency is clearly a tacit vehicle for avoiding responsibilities associated with such changes."

She took an exaggerated deep breath.

"Whew! That Anderson is a long-winded son of a gun. So they stuck you with his book in Behav. Psych. too, huh?" She smiled sweetly.

"Why, yes. That is, we read it. How did you know?"

"Saw it on your bookshelf. Do you have any candy?"

"Uh, no."

"Too bad. The last social worker I dealt with always kept some on hand. You ought to, too. Good for public relations." Melissa looked aimlessly around the room.

May shook herself again. She hadn't felt so out of control in years. Not since they tried her out on the black ghetto kids. She dug in her heels.

"That was a very pretty performance, Melissa. I see you do read a lot. But did it ever occur to you that what Anderson said might still apply to you? Even if you do make a joke out of it."

"You mean, do I watch what I eat, because I'm afraid to grow up?" A nod. "You'd better believe it. But not because of that guff Anderson propagates."

The girl glanced at the photographs on the desk, looked keenly into May's eyes.

"Mrs. Foster, how open-minded are you? No, strike that. I've yet to meet a bigot who didn't think of himself as Blind Justice, Incarnate. Let's try a more pragmatic test. Do you read science fiction?"

"Uh, some."

"Fantasy?"

"A little."

"Well, what do you think of it? I mean, do you enjoy it?" Her eyes bored.

"Well, uh, I guess I like some of it. Quite a bit of it leaves me cold." She hesitated. "My husband reads it mostly. And my father-in-law. He's a biochemist," she added lamely, as though that excused something.

Melissa shrugged her adult shrug, made up her mind.

"What would you say if I told you my father was a wizard?"

"Frankly, I'd say you've built up an elaborate delusional system about your unknown parents. Orphans often do, you know."

"Yeah, Anderson again. But thanks for being honest; it was the right answer for you. I suspect, however," she paused, fixed the woman with an unwavering sidelong glance, "you're willing to believe that I might be more than your average maladjusted foster child."

Under that stare, May could do nothing but nod. Once. Slowly.

"What would you say if I told you that I am over twenty-four hundred years old?"

May felt surprise, fear, elation, an emotion that had no name.

"I'd say that you ought to meet my husband."

The child sat at the dinner table with her hands folded neatly on her lap. The three adults toyed with their aperitifs and made small talk. Melissa responded to each effort to bring her into the conversation with a few polite words, just the right number of just the right words for a well-behaved child to speak when she is a first-time dinner guest among people who hardly know her. But she never volunteered any small talk of her own.

George Foster, Jr., sensed that the seemingly innocent child sitting across from him was waiting them out, but he couldn't be sure. One thing he was sure of was that if this child were indeed older than Christendom he didn't have much chance against her in intellectual games. That much decided, he was perfectly willing to play out the evening in a straightforward manner. But in his own good time.

"Would you start the salad around, Dad?" he prompted. "I hope you like endive, Melissa. Or is that also a taste acquired in adulthood, like alcohol?" The girl had refused a dry sherry, politely but firmly.

"I'm sure I'll enjoy the salad, thank you. The dressing smells delicious. It's a personal recipe, isn't it?"

"Yes, as a matter of fact it is," George said in mild surprise. He suddenly realized that he habitually classified all thin people as picky, indifferent eaters. A gastronome didn't have to be overweight.

"Being a history professor gives me more freedom to schedule my time than May has," he found himself explaining. "It is an easy step from cooking because you must, to cooking because you enjoy it. That mustard dressing is one of my earliest inventions. Would you like the recipe?"

"Yes, thank you. I don't cook often, but when I do I like to produce something better than average." She delivered the pretty compliment with a seeming lack of guile. She also avoided, George noted, responding to the veiled

probe about her age. He was becoming more and more impressed.

They broke bread and munched greens.

How do I handle this? By the way, May tells me you're twenty-four hundred years old. He met his father's eye, caught the faintest of shrugs. *Thanks for the help.*

"By the way, May tells me you were in England for a while." Now why in hell did he say that?

"I didn't actually say so, but yes, I was. Actually, we discussed the Industrial Revolution, briefly."

Were you there?

"I'm a medievalist, actually, but I'm also a bit of an Anglophile." George caught himself before he could lapse into the clipped, pseudo-British accent that phrase always triggered in him. He felt particularly vulnerable to making an ass of himself under that innocent gaze.

"Do you know much about English royalty?" He was about as subtle as a tonsillectomy.

"We studied it in school some."

"I always wanted to be another Admiral Nelson. Damned shame the way he died. What was it the king said after his funeral, it was Edward, I think—"

Melissa put her fork down.

"It was King George, and you know it. Look, before I came here I lived in Berkeley for a while." She caught May's look. "I know what my records say. After all, I wrote them . . . as I was saying, I was in Berkeley a few years back. It was right in the middle of the worst of the student unrest and we lived not three blocks from campus. Every day I walked those streets and every night we'd watch the riots and the thrashing on TV. Yet not once did I ever see one of those events with my own eyes."

She looked at them each in turn.

"Something could be happening a block away, something that attracted network television coverage and carloads of police, and I wouldn't know about it until I got home and turned on Cronkite. I think I may have smelled tear gas, once."

She picked up her fork.

"You can quiz me all you want to, Dr. Foster, about admirals and kings and dates. I guess that's what history is all about. But don't expect me to tell you about anything I didn't learn in school. Or see on television."

She stabbed viciously at a last scrap of endive. They watched her as she ate.

"Kids don't get invited to the events that make history. Until very recently all they ever did was work. Worked until they grew old or worked until they starved or worked until they were killed by a passing war. That's as close as most kids get to history, outside the classroom. Dates don't mean much when every day looks like every other."

George was at a loss for some-

thing to say after that, so he got up and went to the sideboard where the main dishes were being kept warm. He made an elaborate exercise out of removing lids and collecting hot pads.

"Are you really twenty-four hundred years old?" asked George Foster, Sr. There, it was out in the open.

"Near as I can tell," spooning chicken and dumplings onto her plate. "Like I said, dates don't mean much to a kid. It was two or three hundred years before I gave much thought to when everything started. By then, it was a little hard to reconstruct. I make it twenty-four hundred and thirty-three years, now. Give or take a decade."

Give or take a decade!

"And your father was a magician?" May pursued.

"Not a magician, a wizard." A little exasperated. "He didn't practice magic or cast spells; he was a wise man, a scholar. You could call him a scientist, except there wasn't too much science back then. Not that he didn't know a lot about some things—obviously he did—but he didn't work with an *organized* body of knowledge the way people do now."

Somehow she had contrived to fill her plate and make a noticeable dent in her chicken without interrupting her narrative. George marveled at the girl's varied social talents.

"Anyway, he was working on a method of restoring youth. Everybody was, in those days. Very stylish. There was actually quite a bit of progress being made. I remember one old geezer actually renewed his sex life for about thirty years."

"You mean, you know how to reverse aging?" George, Sr. asked intently. The candlelight couldn't erase all the lines in his face.

"Sorry, no, I didn't say that." She watched the elder Foster's expression closely, her tone earnestly entreating him to believe her. "I just said I know of one man who did that once. For a while. But he didn't tell anyone else how he did it, as far as I know. The knowledge died with him."

Melissa turned to the others, looking for supporting belief.

"Look, that's the way people were, up until the last few centuries. Secrecy was what kept science from blossoming for so long. I saw digitalis appear and disappear at least three times before it became common knowledge . . . I really can't help you." Gently.

"I believe you, child." George, Sr. reached for the wine bottle.

"My father spent most of his time trying to second-guess the competition. I suppose they were doing the same thing. His only real success story was me. He found a way to stop the aging process just before puberty, and it's worked for me all this time."

"He told you how he did it?" George, Sr. asked.

"I know what to do. I don't understand the mechanism, yet. I know it's of no use to adults."

"You've tried it?"

"Extensively." An iron door of finality clanged in that word.

"Could you describe the method?"

"I could. I won't. Perhaps I am just a product of my age, but secrecy seems to be the only safe haven in this matter. I've had a few painful experiences." They waited, but she did not elaborate.

George, Jr. got up to clear the table. He reached to pick up a plate and stopped.

"Why have you told us all this, Melissa?"

"Isn't it obvious?" She folded her hands on her lap in that posture of infinite patience. "No, I suppose it isn't unless you've lived as I have.

"After my father died, I hung around Athens for a while—did I mention, that's where we lived? But too many people knew me and began to wonder out loud about why I wasn't growing up. Some of the other wizards began to eye me speculatively, before I wised up and got out of town. I didn't want to die a prisoner before anyone figured out I had nothing useful to divulge.

"I soon found that I couldn't escape from my basic problem. There's always someone happy to take in a child, particularly a healthy one that's willing to do more than her share of the work. But after a few years, it would become obvious that I was not growing up like other children. Suspicion would lead to fear, and fear always leads to trouble. I've learned to judge to a nicety when it's time to move on."

George, Jr. placed a covered server on the table and unveiled a chocolate layer cake. Like all children throughout time, Melissa grinned in delight.

"It's a decided nuisance looking like a child—*being* a child—particularly now. You can't just go get a job and rent your own apartment. You can't apply for a driver's license. You have to *belong* to someone and be in school, or some government busybody will be causing trouble. And with modern record-keeping, you have to build a believable existence on paper too. That's getting harder all the time."

"It would seem to me," interposed George, Jr., "that your best bet would be to move to one of the less developed countries. In Africa, or South America. There'd be a lot less hassle."

Melissa made a face.

"No, thank you. I learned a long time ago to stick with the people who have the highest standard of living around. It's worth the trouble. . . *Nur wer in Wohlstand lebt, lebt angenehm.* You know Brecht? Good."

The girl gave up all pretense of

conversation long enough to demolish a wedge of cake.

"That was an excellent dinner. Thank you." She dabbed her lips daintily with her napkin. "I haven't answered your question completely.

"I'm telling you all about myself because it's time to move on again. I've overstayed my welcome with the Stuarts. My records are useless to me now—in fact they're an embarrassment. To keep on the way I've been, I'll have to manufacture a whole new set and insinuate them into someone's files, somewhere. I thought it might be easier this time to take the honest approach."

She looked at them expectantly.

"You mean, you want us to help you get into a new foster home?" George, Jr. strained to keep the incredulity out of his voice.

Melissa looked down at her empty dessert plate.

"George, you are an insensitive lout," May said with surprising fervor. "Don't you understand? She's asking us to take her in."

George was thunderstruck.

"Us? Well, ah. But we don't have any children for her to play with. I mean—" He shut his mouth before he started to gibber. Melissa would not look up. George looked at his wife, his father. It was clear that they had completely outpaced him and had already made up their minds.

"I suppose it's possible," he muttered lamely.

The girl looked up at last, tears lurking in the corners of her eyes.

"Oh, please. I'm good at housework and I don't make any noise. And I've been thinking—maybe I don't know much history, but I do know a lot about how people lived in a lot of different times and places. And I can read all sorts of languages. Maybe I could help you with your medieval studies." The words tumbled over each other.

"And I remember some of the things my father tried," she said to George, Sr. "Maybe your training in biochemistry will let you see where he went wrong. I know he had some success." The girl was very close to begging, George knew. He couldn't bear that.

"Dad?" he asked, mustering what aplomb he could.

"I think it would work out," George, Sr. said slowly. "Yes. I think it would work out quite well."

"May?"

"You know my answer, George."

"Well, then." Still half bewildered. "I guess it's settled. When can you move in, Melissa?"

The answer, if there was one, was lost amidst scraping of chairs and happy bawling noises from May and the girl. *May always wanted a child,* George rationalized, *perhaps this will be good for her.* He exchanged a tentative smile with his father.

May was still hugging Melissa enthusiastically. Over his wife's

shoulder, George could see the child's tear-streaked face. For just one brief moment, he thought he detected an abstracted expression there, as though the child was already calculating how long this particular episode would last. But then the look was drowned in another flood of happy tears and George found himself smiling at his new daughter.

The child sat under the tree with her hands folded neatly on her lap. She looked up as George, Sr. approached. His gait had grown noticeably less confident in the last year; the stiffness and teetery uncertainty of age could no longer be ignored. George, Sr. was a proud man, but he was no fool. He lowered himself carefully onto a tree stump.

"Hello, Grandpa," Melissa said with just a hint of warmth. She sensed his mood, George, Sr. realized, and was being carefully disarming.

"Mortimer died," was all he said.

"I was afraid he might. He'd lived a long time, for a white rat. Did you learn anything from the last blood sample?"

"No." Wearily. "Usual decay products. He died of old age. I could put it fancier, but that's what it amounts to. And I don't know why he suddenly started losing ground, after all these months. So I don't know where to go from here."

They sat in silence, Melissa patient as ever.

"You could give me some of your potion."

"No."

"I know you have some to spare—you're cautious. That's why you spend so much time back in the woods, isn't it? You're making the stuff your father told you about."

"I told you it wouldn't help you any and you promised not to ask." There was no accusation in her voice, it was a simple statement.

"Wouldn't you like to grow up, sometime?" he asked at length.

"Would you choose to be Emperor of the World if you knew you would be assassinated in two weeks? No, thank you. I'll stick with what I've got."

"If we studied the makeup of your potion, we might figure out a way to let you grow up and still remain immortal."

"I'm not all that immortal. Which is why I don't want too many people to know about me or my methods. Some jealous fool might decide to put a bullet through my head out of spite . . . I can endure diseases. I even regrew a finger once—took forty years. But I couldn't survive massive trauma." She drew her knees up and hugged them protectively.

"You have to realize that most of my defenses are prophylactic. I've learned to anticipate damage and avoid it as much as possible.

But my body's defenses are just extensions of a child's basic resource, growth. It's a tricky business to grow out of an injury without growing up in the process. Once certain glands take over, there's no stopping them.

"Take teeth, for instance. They were designed for a finite lifetime, maybe half a century of gnawing on bones. When mine wear down, all I can do is pull them and wait what seems like forever for replacements to grow in. Painful, too. So I brush after meals and avoid abrasives. I stay well clear of dentists and their drills. That way I only have to suffer every couple of hundred years."

George, Sr. felt dizzy at the thought of planning centuries the way one might lay out semesters. Such incongruous words from the mouth of a little girl sitting under a tree hugging her knees. He began to understand why she almost never spoke of her age or her past unless directly asked.

"I know a lot of biochemistry, too," she went on. "You must have recognized that by now." He nodded, reluctantly. "Well, I've studied what you call my 'potion' and I don't think we know enough biology or chemistry yet to understand it. Certainly not enough to make changes.

"I know how to hold onto childhood. That's not the same problem as restoring youth."

"But don't you want badly to be able to grow up? You said yourself what a nuisance it is being a child in the Twentieth Century."

"Sure, it's a nuisance. But it's what I've got and I don't want to risk it." She leaned forward, chin resting on kneecaps.

"Look, I've recruited other kids in the past. Ones I liked, ones I thought I could spend a long time with. But sooner or later, every one of them snatched at the bait you're dangling. They all decided to grow up "just a little bit." Well, they did. And now they're dead. I'll stick with my children's games, if it please you."

"You don't mind wasting all that time in school? Learning the same things over and over again? Surrounded by nothing but children? *Real* children?" He put a twist of malice in the emphasis.

"What waste? Time? Got lots of that. How much of your life have you spent actually doing research, compared to the time spent writing reports and driving to work? How much time does Mrs. Foster get to spend talking to troubled kids? She's lucky if she averages five minutes a day. We all spend most of our time doing routine chores. It would be unusual if any of us did not.

"And I don't mind being around kids. I like them."

"I never have understood that," George, Sr. said half abstractedly. "How well you can mix with children so much younger than you.

How you can act like them."

"You've got it backwards," she said softly. "They act like me. All children are immortal, until they grow up."

She let that sink in for a minute.

"Now I ask you, Grandpa, you tell me why I should want to grow up."

"There are other pleasures," he said eventually, "far deeper than the joys of childhood."

"You mean sex? Yes, I'm sure that's what you're referring to. Well, what makes you think a girl my age is a virgin?"

He raised his arms in embarrassed protest, as if to ward such matters from his ears.

"No, wait a minute. You brought this up," she persisted. "look at me. Am I unattractive? Good teeth, no pock marks. No visible deformities. Why, a girl like me would make first-rate wife material in some circles. Particularly where the average life expectancy is, say, under thirty-five years—as it has been throughout much of history. Teen-age celibacy and late marriage are conceits that society has only recently come to afford."

She looked at him haughtily.

"I have had my share of lovers, and you can bet I've enjoyed them as much as they've enjoyed me. You don't need glands for that sort of thing so much as sensitive nerve endings—and a little understanding. Of course, my boyfriends were all a little disappointed when I failed to ripen up, but it was fun while it lasted.

"Sure, it would be nice to live in a woman's body, to feel all those hormones making you do wild things. But to me, sex isn't a drive, it's just another way of relating to *people.* I already recognize my need to be around people, uncomplicated by any itches that need scratching. My life would be a lot simpler if I could do without others, heaven knows. I certainly don't have to be forced by glandular pressure to go in search of company. What else is there to life?"

What else, indeed? George, Sr. thought bitterly. One last try.

"Do you know about May?" he asked.

"That she can't have children? Sure, that was pretty obvious from the start. Do you think I can help her? You do, yes. Well, I can't. I know even less about that than I do about what killed Mortimer."

Pause.

"I'm sorry, Grandpa."

Silence.

"I really am."

Silence.

Distantly, a car could be heard approaching the house. George, Jr. was coming home. The old man got up from the stump, slowly and stiffly.

"Dinner will be ready soon." He turned toward the house. "Don't be late. You know your mother doesn't like you to play in the woods."

* * *

The child sat in the pew with her hands folded neatly on her lap. She could hear the cold rain lash against the stained glass windows, their scenes of martyrdom muted by the night lurking outside. Melissa had always liked churches. In a world filled with change and death, church was a familiar haven, a resting place for embattled innocents to prepare for fresh encounters with a hostile world.

Her time with the Fosters was over. Even with the inevitable discord at the end, she was already able to look back over her stay with fond remembrance. What saddened her most was that her prediction that first evening she came to dinner had been so accurate. She kept hoping that just once her cynical assessment of human nature would prove wrong and she would be granted an extra year, even an extra month, of happiness before she was forced to move on.

Things began to go really sour after George, Sr. had his first mild stroke. It was George, Jr. who became the most accusatory then. (The old man had given up on Melissa; perhaps that was what angered George, Jr. the most.) There was nothing she could say or do to lessen the tension. Just being there, healthy and still a prepubescent child unchanged in five years of photographs and memories—her very presence made a mockery of the old man's steady retreat in the face of mortality.

Had George, Jr. understood himself better, perhaps he would not have been so hard on the girl. (But then, she had figured that in her calculations.) He thought it was May who wanted children so badly, when in actuality it was his own subconscious striving for that lesser form of immortality that made their childless home ring with such hollowness. All May begrudged the child was a second chance at the beauty she fancied lost with the passing of youth. Naturally May fulfilled her own prophecy, as so many women do, by discarding a little more glow with each passing year.

George, Jr. took to following Melissa on her trips into the woods. Anger and desperation gave him a stealth she never would have otherwise ascribed to him. He found all her hidden caches and stole minute samples from each. It did him no good, of course, nor his father, for the potion was extremely photoreactant (her father's great discovery and Melissa's most closely guarded secret). The delicate long chain molecules were smashed to a meaningless soup of common organic substances long before any of the samples reached the analytical laboratory.

But that thievery was almost her undoing. She did not suspect anything until the abdominal cramps started. Only twice before in her long history—both times of severe

famine—had that happened. In a pure panic, Melissa plunged deep into the forest, to collect her herbs and mix her brews and sleep beside them in a darkened burrow for the two days it took them to ripen. The cramps abated, along with her panic, and she returned home to find that George, Sr. had suffered a second stroke.

May was furious—at what, she could not say precisely—there was no talking to her. George, Jr. had long been a lost cause. Melissa went to her room, thought things over a while, and prepared to leave. As she crept out the back door, she heard George, Jr. talking quietly on the telephone.

She hot-wired a neighbor's car and set off for town. Cars were pulling into the Foster's drive as she went past, hard-eyed men climbing out. Melissa had cowered in alleyways more than once to avoid the gaze of Roman centurions. These may have been CIA, FBI, some other alphabet name to disguise their true purpose in life, but she knew them for what they were. She had not left a minute too soon.

No one thinks to look for stolen cars when a child disappears; Melissa had some time to maneuver. She abandoned the sedan in town less than a block away from the bus depot. At the depot, she openly bought a one-way ticket to Berkeley. She was one of the first aboard and made a point of asking the driver, in nervous little-girl fashion, whether this was really the bus to Berkeley. She slipped out while he was juggling paperwork with the dispatcher.

With one false trail laid, she was careful not to go running off too quickly in another direction. Best to lay low until morning, at least, then rely more on walking than riding to get somewhere else. Few people thought to walk a thousand miles these days; Melissa had done it more times than she could remember.

"We have to close up, son," a soft voice said behind her. She suddenly remembered her disguise and realized the remark was addressed to her. She turned to see the priest drifting toward her, his robes rustling almost imperceptibly. "It's nearly midnight," the man said with a smile, "you should be getting home."

"Oh, hello, Father. I didn't hear you come in."

"Is everything all right? You're out very late."

"My sister works as a waitress, down the block. Dad likes me to walk her home. I should go meet her now. Just came in to get out of the rain for a bit. Thanks."

Melissa smiled her sincerest smile. She disliked lying, but it was important not to appear out of place. No telling how big a manhunt might be mounted to find her. She had no way of knowing how much the Fosters would be be-

lieved. The priest returned her smile.

"Very good. But you be careful too, son. The streets aren't safe for anyone, these days."

They never have been, Father.

Melissa had passed as a boy often enough in the past to know that safety, from anything, depended little on sex. At least not for children.

That business with the centurions worried her more than she cared to admit. The very fact that they turned out in such numbers indicated that George, Jr. had at least partially convinced someone important.

Luckily, there was no hard evidence that she was really what she said she was. The samples George, Jr. stole were meaningless and the pictures and records May could produce on her only covered about an eight-year period. That was a long time for a little girl to remain looking like a little girl, but not frighteningly out of the ordinary.

If she was lucky, the rationalizations had already begun. Melissa was just a freak of some kind, a late maturer and a con artist. The Fosters were upset—that much was obvious—because of George, Sr. They should not be believed too literally.

Melissa could hope. Most of all she hoped that they didn't have a good set of her fingerprints. (She had polished everything in her room before leaving.) Bureaucracies were the only creatures she could not outlive—It would be very bad if the US Government carried a grudge against her.

Oh well, that was the last time she would try the honest approach for quite some time.

The rain had backed off to a steady drizzle. That was an improvement, she decided, but it was still imperative that she find some shelter for the night. The rain matted her freshly cropped hair and soaked through her thin baseball jacket. She was cold and tired.

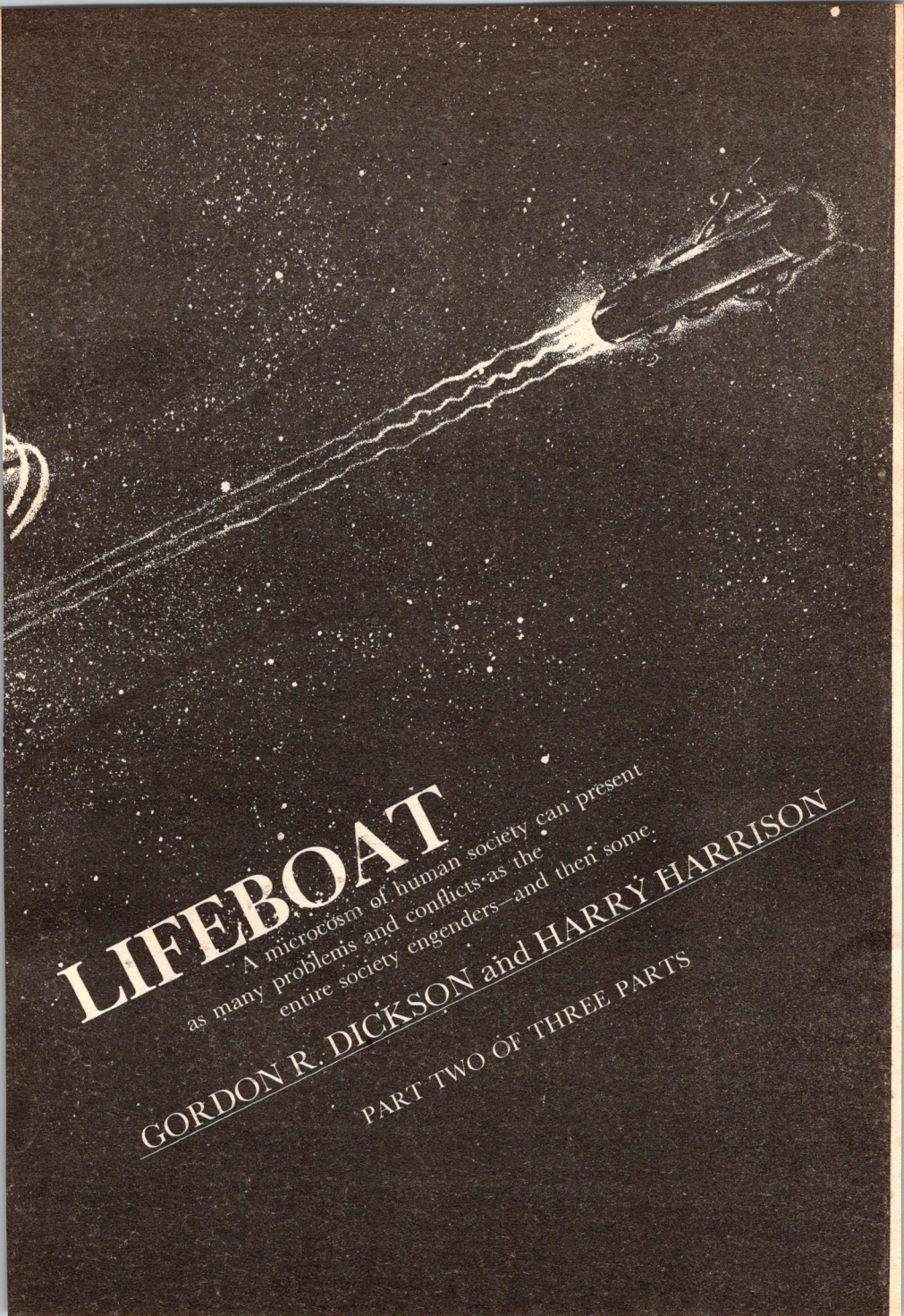
Melissa dredged up the memories, nurtured over the centuries, of her first, real childhood. She remembered her mother, plump and golden-haired, and how safe and warm it was curled up in her lap. That one was gone now, along with millions of other mothers out of time. There was no going back.

Up ahead, on the other side of the street, a movie marquee splashed light through the drizzle. Black letters spelled out a greeting:

WALT DISNEY
TRIPLE FEATURE
CONTINUOUS PERFORMANCES
FOR CHILDREN OF ALL AGES

That's me, Melissa decided, and skipped nimbly over the rain-choked gutter. She crossed the street on a long diagonal, ever on the lookout for cars, and tendered up her money at the ticket window. Leaving rain and cold behind for a time, she plunged gratefully into the warm darkness. ■

KELLY FREAS



LIFEBOAT

A microcosm of human society can present as many problems and conflicts as the entire society engenders—and then some.

GORDON R. DICKSON and HARRY HARRISON

PART TWO OF THREE PARTS

A large passenger spaceship owned and operated by the Albenareth, an alien race which makes a religion out of going into space and which has become the supplier of interstellar transportation for the human race traveling between Earth and its Colony Worlds, is wrecked by a mysterious explosion. The only individuals to reach a lifeboat and escape are two Albenareth and eight humans. The two aliens are the Albenareth Captain, and the Albenareth Engineer. The humans include Giles Ashad of Steel, *an Adelman (one of the aristocratic management class), plus a handful of arbites (members of the human working class).*

The three female arbites are an older woman named Biset, a capable-looking younger girl called Mara, and a second girl named Di, who is married to Frenco, one of the male arbites. The three other male arbites are an older calculations man named Groce, an arbite named Esteven whose work-area is music, and a manual-laboring arbite named Hem, who alone among the rest stands as tall as Giles, and is even more heavily muscled.

The Albenarthian lifeboat is a small craft with a primitive closed ecological system: the sanitary conveniences attach to the nutrient tank which feeds the ib *vine, a plant which both regenerates the atmosphere aboard the lifeboat and produces fruit to supply the passengers with juice and pulp for liquid and solid nourishment. The* ib *vine is fed by a bank of perpetual bright lights in the ceiling of the lifeboat.*

The lifeboat has no permanent compartments. But there are temporary partitions which the humans erect to divide the body of the ship roughly into three sections, not counting the Control Section up front, which has its own special pull-down screen. It is behind this screen that the Captain and Engineer spend most of their time.

Giles, as the only Adelman aboard, automatically takes command of the other humans. He calms the arbites, sees that they set up the partitions and pull their cots from the flooring of the lifeboat. Then he goes forward to talk with the two Albenareth in their own language. In all these things he has drawn upon the unlimited education which has been his right as one of the Adelborn (as opposed to the arbites, who are given only a limited education, for which each must sign a forty-year work contract). Giles speaks to the Captain, discovering she is female (the Engineer is male) and he decides to keep this knowledge a secret from the arbites because of their superstitions about the danger of the Albenarthian female when she is sexually excited.

The Captain, whose courtesy title is "Rayumung" (as the Engineer's courtesy title is "Munghanf") tells Giles that her honor demands that she continue with the lifeboat on the starship's original course to the

planet Belben—even though Giles points out that there may be a much nearer human colony. He has, in fact, a small mining world in mind, called 20B-40, less than half as distant from them as Belben. But the Captain refuses to consider another destination.

Giles has his own reasons for wanting to go to 20B-40. He carries a warrant for the arrest of Paul Oca, another Adelman. Paul is the founder of the Oca Front, a philosophical-liberal society of which Giles is a member. Paul, however, has become more and more radical, finally advocating that the Adelborn's unlimited education be made available to the arbites immediately, *even though it will take another seventy years of arbite work under the present system to build the spacecraft needed to make humanity independent of the Albenareth.*

Now Paul is being hunted by the World Police. He has escaped from Earth to a Colony World, plainly with the aid of some revolutionary arbite group. Consequently, the Oca Front (which advocates a more gradual relaxation of education restrictions and of the rigid Adelborn-Arbite system) also is searching for him in the person of Giles, whose job must be to assassinate his old friend so that the arbites cannot make use of him as a leader in a radical revolt against the existing system. Giles has information that Paul is on 20B-40; and is following that information although he hates the job as assassin. Still, the sense of duty trained into him, he knows, will compel him to go through with it when the time comes, just as the same sense of duty makes him an instinctive protector and guardian of the arbites aboard, when the Captain suggests that one of them be destroyed to produce a more desirable number aboard the lifeboat.

Giles, having failed to talk the Captain into changing course, finds them all faced with a repair that must be made outside the lifeboat. The Engineer will do the actual work, but the Captain and Giles must help from inside the ship. The spacesuit the Engineer must wear is old and probably unsafe—in fact, most of the Albenareth spacecraft are aged and in bad repair, reflecting a cultural problem producing decay toward a dead end among the alien race. The Engineer is probably going to his death, but he considers it holy to die in space.

The Captain and Giles put protective ties around the limbs of the spacesuit. While Giles is practicing his part of the job, he is approached by Biset, who reveals that she is a World Police spy and warns him to beware of Mara, whom Biset believes to belong to the notorious Black Thursday *arbite revolutionary group. The Engineer goes out and makes the repair; but when Giles, at the Captain's direction, manages to get the Engineer back inside, it is clear that his spacesuit has failed and that he is dying. The Captain*

takes the Engineer into the back section of the lifeboat and warns all the humans to stay out.

Giles, exhausted, falls asleep on his cot—as do the other humans. They are awakened by a woman's screams; and Giles, leading the way into the back of the lifeboat, finds the area spattered with dark alien blood and the Engineer's body already fed into the nutrient tank that supports the ib *vine. Di dangles unconscious from the Captain's long, powerful, three-fingered hands. The Captain hands the girl to Giles, and stalks forward to the Control Section, refusing to explain what Di was doing there and what she has seen to make her scream so. The arbites then question Giles; but he answers that when Di comes to, she may well not remember what shocked her.*

Part Two

6

Second Day—16:15 hours

Giles had been right in his unprofessional guess. When Di came to, after she had been carried into a cot in the middle section, she did not remember. She seemed confused and uncertain, like someone who had just recovered from the effects of a heavy drug. She cried and clung to Mara or Biset, whoever was closer. She threatened to become hysterical if any of the men came near her, including Frenco—whom she did not seem to recognize at all.

In the end, the two other women took turns sitting with her; and bit by bit she dropped into short periods of uneasy sleep, from which she was as likely to wake screaming as not. But, gradually, the violence of her nightmares seemed to diminish; and she began to sleep for longer and more normal periods. But she did not remember anything of what she had seen in the stern area of the lifeboat. Her last memory was of the Engineer being brought back through the airlock.

Frenco, meanwhile, in the space of less than twenty-four hours, went from a round-faced boy to a pale, sharp-featured man on the edge of violence. He could not believe that Di did not want him near her and was ready to fight his way to her. In the end, Giles had to appoint Hem to guard the girl against Frenco's approaches.

Meanwhile, the rest of the humans were close to a condition of total anarchy. With the exception of Hem, who was apparently undisturbed by the disposition of the Engineer's body, and Giles, who forced himself to eat, none of the others would touch the pulp of the fruit from the *ib* vine. Indeed, with the exception of Hem and Giles, the humans held off drinking the *ib* juice until thirst literally drove them to it. But eat, they would not. Finally, Giles called them all together in the center section between the screens.

"Now listen to me," he said. "Try to understand. We're out here alone in space, surrounded by light-years of emptiness; and this lifeboat is the only chance we have of ever making it to planetfall again. If we ever get out of this alive, we'll have to thank the lifeboat and the Captain—yes, the Engineer too. Don't look away from me when I say that. Make an effort to think outside all the things you grew up with and learned and took for granted. What we have here—this closed cycle with the converter—is exactly the same kind of closed cycle we had back on Earth, only simplified. —Look at me when I talk to you!"

Pale faces that had been averted turned back to him. That much he could make them do—obey the physical command. Whether he could actually get them to think in terms of this new and alien environment was something else again. Well—at least he could try.

"I want you to look at matters squarely, with your feelings set aside," he went on. "The drive motors needed to be worked on. That is a fact. The Engineer had to go outside and work on them, at the cost of his life, which was a price he expected to pay. Another *fact.* It did cost him his life; and the Captain, rather than wasting nutrients which would help keep us alive—us humans, remember, not just some equivalent number of individuals of his own race—put the Engineer's body in the recycling tank to feed the *ib* vine. *Fact.* There they are—facts. Not matters of opinion which you can react to or not—but facts. Because if you don't accept them as the facts they are, the final fact of all will get you—if you don't eat, you'll die."

"Kept him alive, too . . ." muttered a male voice.

"Who's that? Esteven?" Giles stared at the entertaincomp. Unlike the others, Esteven was not particularly pale. If anything, he was a little flushed and there was a glazed, defiant look to his eyes. "What do you mean—kept who alive, too?"

"I mean him—the Captain!" said Esteven, more loudly. "He lives off the *ib* vine, too—and the Engineer. I say he was keeping himself alive by putting the Engineer in there—Honor, sir!"

The last two words were uttered almost impudently. But Giles paid little attention. He was busy adjusting his own mind. He had forgotten that the arbites believed the Albenareth Captain to be a male. For a moment he toyed with the idea of telling them the truth about the alien commander's sex, then rejected it. The less confusion and surprises from now on, the better.

"The Albenareth don't fight the prospect of death the way we do, Esteven," Giles said, evenly. "You know that. What makes the Captain run is a sense of duty, not personal worries."

"Pardon me, Honor, sir," said Esteven, "but are you sure about that?" The ordinarily quiet and withdrawn man was acting out of his usual character at the moment. He was almost belligerent.

It was time to sit on him, thought Giles.

"When I tell you anything, Esteven," he said, harshly and finally, "you can take it for granted that I'm sure about it, or I wouldn't say it. Now, unless you've got something more useful to say, I want you to sit there and be quiet. Do you understand?"

"Yes, Honor, sir . . ." All at once the belligerence went out of the arbite. He shrank back into his usual silence and inconspicuousness.

"All right," said Giles, turning to the others. "I'm not going to order you to eat. I'm going to appeal to you to try to eat; and until you do, all of you are going to be required to sit here, twice a ship's-day, and watch while Hem and I eat. And that first meal is going to be right now. —Hem?"

The big laboring arbite got up, stepped into the rear section and returned with two bowls of the *ib* pulp. He handed one to Giles and sat down on a cot with the other.

Giles ate stolidly, hiding his own feelings about the Engineer and the vine-pulp under the mask of indifference he had learned during that first year after being sent away to boarding school. Hem was truly indifferent. The watching arbites sat silently, bearing up under the scene they were witnessing very well—until the very end when Hem thoughtlessly began to lick the stray pulp from his fingers and first Di, then Groce and Frenco, were abruptly sick, crowding into the sanitary cubicle with little energy left over to be considerate of each other.

Much the same scene was repeated six hours later, and again for three more times before Biset and Mara, at once, sat down with bowls holding hardly more than a tablespoonful apiece of the *ib* pulp and choked it down. Two mealtimes later and they were all eating, including Di.

Meanwhile, Di and Frenco had moved back into the spurious privacy of the rear section of the lifeboat. Another cot had been pulled up from the floor to take the place of the one the Captain had torn from its fastening to bar the entrance in the screen. The rest were all in the center section with the exception of Hem, who had moved to a cot up in the front section where Giles had been by himself until the Engineer's death.

It was a curiously forward thing for the low-graded bumper to do on his own initiative; but Giles thought it best not to question the man about it. Most arbites of Hem's type, questioned about anything, became overwhelmed with embarrassment and tongue-tied with

the fear of not giving the proper answers. Meanwhile, things were going as smoothly as could be expected, now that all of the humans were finally adjusted to the lifeboat's environment and eating correctly once more. Giles turned the situation over in his own mind. It was one in which ordinarily he would offer the arbites some kind of reward to reinforce the positive effect of their good behavior. But here on the lifeboat, rewards were not easily available.

He hit finally on a far-fetched possibility. He must talk to the Captain anyway, and that conversation would provide an opportunity for the asking of a special consideration. He waited until several ship's days after the death of the Engineer before approaching the other Albenareth.

Choosing a time when the arbites were all in the middle or stern section of the craft, Giles went up to the partition within which the Captain had been keeping herself isolated almost continuously since the Engineer's death. Standing outside the screen that hid the alien commander, Giles spoke in Albenareth.

"Captain, I'd like to talk to you."

There was a moment's pause, then the sound of the alien voice answered: *"Come."*

Giles walked around the edge of the screen and turned to face the Captain, who was sitting before one of the control consoles. Without getting up, she swiveled her command seat to face him.

"Captain," said Giles, *"perhaps you can tell me how long it will be before we make planetfall in this lifeboat?"*

"We will reach Belben in a little less than a hundred and eight ship-days."

"I see," said Giles. *"That is a long time."*

"It is the time required," said the Captain. There was no difference that Giles' human ear could find in the Albenareth's tones; and no difference that he could see in the way she sat or spoke. But still, something about her conveyed an impression of remoteness, as if she had somehow put a new distance—not only between herself and him—but between herself and the lifeboat with everyone else aboard it.

"I take it there is no better destination?" asked Giles.

"There is no other destination."

"If the Captain will bear with me," said Giles. He had a feeling as if he was walking through some strange field sowed with booby-traps and mines that he could not imagine, much less see. What he had to say skirted the dangerous perimeter of alien emotions, alien honor. *"There is a human mining colony together with an Albenareth spaceship station, on a world called 20B-40, according to our charts. Out of interest, I studied those charts before leaving on this voyage. I have no skill at navigation, of course, beyond piloting my own small craft*

within my own Solar System; but unless I am mistaken, at this moment 20B-40 would be only perhaps half the distance from us that Belben is."

"Perhaps," said the Captain. *"However, Belben is our destination."*

"Why, when 20B-40 is closer?"

"Belben was our original destination. My ship has been lost, but some honor may be saved if what is left of her passengers are delivered as promised."

"What honor will there be in delivering them, if they are not then living?" Giles asked. *"A hundred and eight days is a long time for these people of mine to survive under these conditions."*

"Survive?" said the Captain. *"Oh yes, I had forgotten how you humans, having no knowledge of the Way and its Portals, shrink and scurry from the thought of Passing. But that is your affair. My duty was only that of delivery—alive or dead—it's all the same to me."*

"It's not the same to me," said Giles. *"I have a responsibility to keep those of my own race alive. I ask you to pilot us instead to 20B-40."*

"No," said the Captain. She closed her eyes as if she was very tired. *"I can afford no more departures from the Way."*

"Captain," said Giles, slowly. *"I am of the house and sept of Steel, and Steel has great wealth, part of which I command personally. If you will turn aside to 20B-40 I will give you my promise—and the promise of an Adelborn is a contract signed—to either pay you whatever is necessary to build you another ship just like the one you lost, or pay to actually have it built by your own people first, and then present it to you. You will have lost nothing, then."*

The Captain opened her eyes and looked at him for a second.

"But I will *have lost,"* she said. *"You are an alien and do not understand. All my crew and officers, now that the Engineer has Passed, won death in the destruction of my ship. To have the ship alone replaced is a hollow thing. It would pleasure me only; but it would be an insult to the honor of my crew and officers who have now gone through the further Portal, if I were to accept something they could not share and which did them no honor."*

She stopped speaking. Giles stood without moving, staring down at her, momentarily without recourse. His offer to her had been the equivalent of holding out a fortune to a pauper. In all his plans for this moment it had never occurred to him that this last and greatest possible price would be refused.

The Captain closed her eyes again.

"This matter is no longer discussable," she said. *"On what other subjects did you wish to speak to me?"*

"There is more ib fruit than is

needed for as small a party as we are presently in this lifeboat," he said. *"At the time of the Engineer's passing, the lights were turned down to a less-bright mode. It would be a great help to my people in enduring this voyage if the lights could be turned down at regular intervals for short periods. Surely the ib vine can supply us with sufficient nourishment in spite of short periods of lessened illumination."*

"The light must remain constant," said the Captain, without opening her eyes. *"All things must remain as they are until we reach our appointed destination. Now,* Adelman, *I am weary of talking and wish privacy."*

"Very well," said Giles. *"I will talk no more with you—now."*

He turned and went back to his cot. He sat down on it, his mind whirling. There had to be a way to make the Captain change their destination to the mining colony on the nearer world. He became aware suddenly that Hem was seated on his own cot, silently watching.

"Don't just sit here!" said Giles, irritated by the big bumper's silent stare. "Do something with yourself. Go back and talk to some of the others. They're never going to include you in things as long as you hide off by yourself!"

Without a word, Hem got up and stepped back through the gap in the screen into the middle section of the boat where most of the other arbites were.

"And the rest of you back in there," added Giles, raising his voice, "Hem's one of you on board here, and I want you to react to him the same way you would to any of the rest of you! Remember that!"

A corner of his mind nibbled at him with small teeth, reminding him that he was taking out his own frustration with the Captain on the arbites, who dared not frustrate him in anything. But he forced himself to ignore the thought. He stretched out on the cot and threw a forearm across his eyes to shut out the never-ending ceiling illumination. Maybe if he slept on the problem he could come up with some idea for changing the Captain's mind.

He woke some time later. There were no arbite voices in conversation beyond the screen next to his cot; but he had the impression that something, some noise, had wakened him. He listened, but all he could hear was the faintest of sounds—a sort of struggling-to-breathe sound.

He sat up silently and swung his legs over the end of his cot. From this position he could see through the gap in the near screen to the cots of the middle section. Each one was occupied by a sleeping figure, but it was from none of them that the faint sound was coming—nor was it from beyond the further screen where Di and Frenco slept.

Puzzled, Giles sat listening. Slowly, his hearing began to get a directional fix on the sound. It came from close by. In fact, it came from the cot across the center aisle from him, the only cot pulled into "up" position in the front part of the lifeboat.

Hem was sleeping there, lying on his side with his clenched fists up in front of his face, his heavy body curled up on the long but narrow cot. Or was the bumper actually asleep? Silently, Giles got to his feet and stepped over to stand by the head of Hem's cot.

The big arbite was crying—in all but perfect silence. His two heavy fists were hiding his face and somehow he had managed to pull loose enough of the fabric covering his cot to stuff into his mouth and muffle the sounds he was making. He lay there on his side, his mouth hidden by the fists and the fabric, the tears running down from his tightly-shut eyes.

Giles frowned. "Hem," he said softly.

The bumper did not respond.

"Hem!" Giles said again, no more loudly, but with more tension in his voice. Hem's eyes flew open and stared up at Giles in what might be either astonishment or panic.

"Hem, what's wrong?" Giles asked.

Hem shook his head, tears still rolling down his cheeks.

Giles gazed down at him for a moment, perplexed. Then he sat down on the floor beside the cot, so that his lips were close to the arbite's ear and he could talk very quietly indeed.

"All right, Hem," he said, softly. "Now you can tell me what's wrong."

Again, Hem shook his head.

"Yes, you can." Giles kept his voice gentle but insistent. "Something's bothering you. What is it, now?"

Hem struggled with himself and finally lifted the muffling fabric from his mouth long enough to say one almost-inaudible word: "Nothing . . ."

"It can't be 'nothing,' " said Giles. "Look at you. Now tell me, what is it that's troubling you? Or, who is it? Answer me."

"I'm sick," whispered Hem.

"Sick? How? What kind of sickness?"

But Hem had the fabric back in his mouth and was saying nothing.

"Hem," said Giles, still gently, "when I ask you a question, I want you to answer me. Where do you feel sick—in your stomach?"

Hem shook his head.

"Where? In your arm or leg? In your head?"

Hem shook his head to all these suggestions.

"What kind of sickness is it?" demanded Giles. "Do you hurt someplace?"

Hem shook his head. Then he closed his eyes and nodded. His

tears began to flow heavily again.

"Well, where then?" Giles asked.

Hem shuddered. Still keeping his eyes closed, he took the fabric from his mouth.

"Yes," he whispered.

" 'Yes' . . . what? What hurts? Your head—arms—legs? Where?"

Hem only shook his head silently. Giles checked his temper, which was threatening to rise. It was not Hem's fault he could not express himself. The responsibility to find words for what was wrong with the big bumper lay not with the arbite who had only a limited vocabulary, but with the Adelman who *could* express himself.

"Tell me if you can, Hem," said Giles, "just when did you start to feel bad? Was it just after we got into the lifeboat? Or just a few hours ago? Or did you feel bad when you were back on the big spaceship?"

. . . Then, at last, it began to come out, in bits and pieces of disjointed sentences. Hem, it seemed, was the exception to what Mara had claimed for all the arbites. The last thing in the world Hem had wanted was to be indent to one of the outer worlds. The reason for this, Giles became aware, had much to do with the status and purpose of Hem's own life back on Earth; a status and purpose Giles had known about all his life but had never appreciated until this moment.

The heavy-duty arbites, those males specially bred to the few hard physical tasks that remained, were essentially a culture apart from the rest of the working class. To keep them from becoming discontented with the relatively simple, repetitive tasks they had to do, they were gene-controlled for a low intelligence level and for those factors that would encourage a feeling of docility and dependence upon their superiors. Theoretically, they were as free as the other arbites; once in a while, one of them succeeded in leaving the work barracks and setting up a permanent family relationship with some normal arbite woman; but this was uncommon.

For all the strength in their oversize bodies, they were timid socially. Most of them lived out their relatively short lives—for some reason they were more than normally vulnerable to diseases, especially pneumonia, and few of them in the barracks lived beyond their middle thirties—almost exclusively in the company of their work-mates.

Hem had been like the rest. To him, the barracks had been the whole world, and his beer-mate, Jase, the closest thing to any kind of family he knew. Conceived, essentially, in a test-tube, raised in a nursery reserved exlcusively for low-intelligence boys like himself, and graduated to the work barracks at the early maturity of thirteen years of age, Hem had been in no way prepared psychologically to be

torn from the only way of life he knew and sent light-years away with no company but that of the superior arbites who had little in common with him. Everything that Hem knew had been taken from him. He would never again have a barracks full of old friends to return to. He would never again know the friendly drinking and the equally friendly brawls of the beer-busts, the jokes, the tricks, the pleasure of working in company with his mates. Above all, he would never see Jase again.

It was a little while before Giles began to put together the incoherent and broken whispers of the big man. What he heard opened his eyes to the fallacy of a great many comforting beliefs he, like everyone else, had always accepted about this lowest class of arbites, without ever stopping to examine them. Those of Hem's special type were supposed to be incorrigibly cheerful because of their ignorance, automatically brave because they did not have the intelligence to know the meaning of fear, and totally unselfconscious, because their size and strength made them indifferent to the opinions of the weaker, but more intelligent humans around them.

None of this was true, he now learned. But the discovery still left him puzzled. Something more than just the difference between his actual nature and the way others thought of him was chewing at Hem. Giles kept after the arbite with gentle, but prodding questions and finally, in the same fragmentary fashion in which Hem had expressed himself about other things, the deeper problem came out.

The important thing for Hem had been his work-mate, Jase. Whether the relationship Hem was trying to describe had been homosexual hardly mattered in the child-like terms in which Hem thought of such things. The important point was that nobody had loved Hem—mother, father, sibling or girlfriend. Only Jase. And Hem had returned that affection. For twelve years of barracks life they had been beer-mates, which in essence meant they did their after-hours drinking always in each other's company.

Then suddenly Hem was taken away, to be shipped to some strange colony on a different world, where it was doubtful that there would be even one other laboring class arbite for him to talk to. He could not even write to Jase—not because he was illiterate, but because it was too much of a creative demand for someone like himself to make a letter anything but an emotionless vehicle for the simplest sort of factual information.

So, suffering under this loss, with his grief completely unsuspected by everyone around him including his so-called fellow arbites, Hem had stumbled even deeper into emotional trouble. He had no name for the new pain within him; he could

not even consciously connect it with its cause—but Giles, eking the information out of him unhappy bit by bit, came to understand what Hem could not admit, even to himself.

Simply, it was that Hem, robbed of Jase, had needed desperately to find someone else to fasten his affections upon. And unconsciously, he had fastened them finally on Giles. Giles, alone among the aliens and upper-caste arbites that now surrounded Hem, showed some of the size, the strength, the characteristics that Hem associated with his own mates.

—And the big arbite's reaction was not so much to wonder at, after all, thought Giles. He compared his own early days in boarding school with Hem's. He and the bumper had been at opposite ends of the social spectrum; but in both cases the irresistible hand of custom and authority had picked them up, molded them, and determined the life they would lead while they were still too young to know what was being done to them. They were equally damned—no, thought Giles, Hem was the better off in one respect. He had been left with the freedom to love—even if it was only one of his mates. Giles had had as close a friendship with Paul Oca as perhaps he had ever had with any other man, but it could not really be said that they were "mates," even in the ordinary, work-meaning of that word in Hem's barracks.

As for girls . . . women . . . it came to Giles suddenly that he had given nothing worthwhile in any of his brief liaisons, and had been scrupulously careful to take nothing. For the first time it occurred to him that no one had ever loved him, and he had really never loved anyone. His own parents had been there in the flesh, but removed from him across barriers of age and manners. His brothers and sisters, if he had ever had any, would have been brought up apart from him to become polite strangers. He did not miss this lack of an affection that was one of the necessary ingredients of life to Hem; but he was aware of its existence. For him, love was duty, and duty, love. That was as far as his emotions would go—and he could see no hope of there ever being anything more for him.

His thoughts came back to Hem. Unconsciously, Hem had taken hold of one of Giles' hands in his own two big fists and was holding it, weeping over it in the depths of his voiceless unhappiness. Hem, Giles realized, would never be able to realize why he was suffering. The perhaps lucky thing about Hem's affection for Giles was that while the bumper felt it, he was completely incapable of acknowledging it. The very suggestion that he might dream of someone like an Adelman being a "mate" to him in

any sense of the word, was so far out of context with life as Hem knew it, that he was mercifully protected from entertaining it consciously. The only way he could approach such a thought was in the desperate wish to do something for Giles, something large and terrible, up to the giving of his life for the Adelman. He tried to tell Giles so, in fragmentary phrases.

"Good," said Giles. "That's very good, Hem. I appreciate it. Don't worry. If ever I need you, I'll call you—right away."

"You will?" said Hem.

"Of course," said Giles. "Of course. Don't let it worry you, Hem. Everything's going to be all right."

"It is?" Hem relaxed at last. He still cried, but now it was out of relief and gratitude—he could not have said why, any more than he had been able to identify the cause of his unhappiness. He clung to Giles' hand and wept.

Giles sat with him patiently for a little while longer, until the bumper dropped off to sleep. Then, gently withdrawing his hand, Giles stood up and stretched stiff muscles. He was cramped from sitting cross-legged on the floor of the lifeboat. Stretching, he made a mental note to find out, once they made planetfall, where, if at all, there were other heavy-laboring arbites stationed on the Colony Worlds. It would probably be impossible to get Hem returned to Earth; but it should not be beyond the bounds of possibility to get his indent changed to some place where he could be with work-mates of his own stamp, if any such place existed on one of the Colony Worlds.

Meanwhile . . . Giles lay down again on his own cot and closed his eyes. There must be some means of convincing the Captain to change the lifeboat's course to 20B-40. Now that he knew that the World Police also believed Paul was on one of the Colony Worlds, they might have men and women out on those worlds hunting Paul now. Time had become a factor in the assassination. Giles had never anticipated that the alien officer in charge of the lifeboat would be this stubborn about maintaining course for the spaceship's original destination.

Why? That was the question. Why was the Captain being so adamant in her refusal to do the sensible thing and head for the nearest safe planetfall? Maybe if he could find out what was motivating her he could do something . . .

7

Two sleep-periods later, Giles was still without an answer to his question, a solution to the problem of how to get the lifeboat turned toward 20B-40. But he was not destined to be left to puzzle over it in peace. As he sat on his cot with Esteven's recorder, talking the last

day's entry into it, there was an explosion of noise from between the screens enclosing the middle section of the ship. Shouts, screams and the sounds of bodies bumping about.

He shoved the recorder into a pocket and went through the gap in the adjoining screen almost as swiftly as he had gone through it when Di had screamed, at the time of the death of the Engineer. In the middle section, Groce had Esteven pinned against one wall of the lifeboat hull and was doing his best to pound the other arbite into unconsciousness. Groce was obviously ten years or more older than Esteven. Also he was the smaller, lighter man and very obviously he had no knowledge of how to fight, beyond a general idea that he should ball his fists and keep swinging them at another person. But his sheer fury was outweighing these small drawbacks. Esteven, caught between two cots and with his back to the metal wall, could not get away from the furious computecom, and it was plain enough that unless he was rescued, Groce was going to succeed eventually in doing him considerable damage.

Giles hurdled a pair of intervening cots and grabbed Groce by the back of the collar and the slack in his coveralls at his waist.

"Stop that!" he snapped, pulling the computecom back out of arm's-reach of Esteven, who sagged against the wall. "Calm down, Groce. –No, no, don't try hitting *me* now. Sit down and be quiet. You, too, Esteven. Sit down on that other cot and tell me what's going on here."

"He–he–" Esteven was almost sobbing. The unnatural flushed look Giles had noticed once before was back on his cheek; and the finger he pointed at Groce trembled. "He's got everything to keep him occupied. He's got a compute. And he's got a book, too. All I wanted was a few pages out of the book so that I could write down some music I've been composing–"

"All!" shouted Groce. The older man's voice scaled upward in outrage. "Just a few pages–that's *all?* A whole handful of pages torn out of my ancestor's book on propositional calculus! I've been working the statements in it, to pass the time. But it's *my* book–and it's priceless! It's over two hundred and twenty-five years old. Do you think I'm going to rip sheets out of a precious family antique like that, just so he can scribble some homemade music notes on it? What's he doing composing music, anyway? Nobody writes any real music nowadays except with a computetank–"

"Groce!" said Giles. Groce went silent.

"He thinks–" began Esteven.

"You, too," said Giles. "Be quiet. Now, Groce, let's see this book."

Glaring at Esteven, Groce reached into a pocket of his cov-

eralls and brought out a brown-covered volume almost small enough to be hidden in the closed hand. But when Giles took it and opened it, he saw that the little pages did, indeed, have a good deal of white space on them, between and around the blocks of printing diagrams.

"It's a math book all right," he said. "Propositional calculus, you said, Groce?"

"That's right, Honor, sir," said Groce, somewhat less truculently, "my grandfather bought it, back before the Green Revolution. It's an heirloom—from the days when computes took up whole floors in buildings."

"A book two hundred and twenty-five years old?" Giles nodded. "I don't blame you for not wanting it damaged, Groce."

He frowned suddenly and took a corner of one page between his middle finger and thumb, rubbing it.

"It's in remarkably good shape for a book that old," he said.

"It's been plastic-injected. All the original materials have been replaced with single-molecule stuff," said Groce, proudly. "My father had it done. Cost him the equivalent of a full month's pay, but it hasn't shown a touch of wear since then, in fifty-four years."

"Plastic?"

The word came from Esteven, in an odd voice. He was staring at the book in Giles hand.

"That's right, Esteven," Giles said. "That's what Groce just told us. What about it?"

"Why . . . nothing," said Esteven, still staring at the book. "I mean . . . I suppose if it's plastic my stylo wouldn't work on it. I wouldn't be able to use the pages to write on, anyway . . ."

"Damned shame you didn't think to ask about that before you tried to steal it from me!" Groce spat at the other arbite.

"I did ask you for it, first—"

"And I told you no!" shouted Groce. "Do I have to give reasons for not wanting to tear up an heirloom book?"

"It might have been a little wiser if you had," Giles said to him, dryly, handing back the book. "Here. From now on keep it someplace where no one can get at it to tear pages out."

He turned back into the front section of the boat and his own cot. Behind him the recorder started up and the familiar three chords of Bosser, backing up the suggestive lyrics of the throaty Singh, followed him.

He sat down on his cot and discovered Mara had followed him. She was standing over him.

"Yes?" he said, looking up at her.

"Could I show you something?" she asked. Her face was serious, almost grim.

"What is it?" he asked.

"If you'll come with me—"

A sudden new explosion of voices broke out in the middle section. The Bosser-Singh combination abruptly gave way to a solo instrument sounding a high-pitched bit of wailing melody. Giles shot up from his couch and strode into the middle section to find Groce trying to tear the recorder out of Esteven's grasp.

"—and kill that kind of thing!" Groce was shouting. "Give us the Bosser and Singh back. That was good!"

"In a minute . . . just a minute," said Esteven, pleadingly. "Just listen a second to this spinny—"

"What d'you mean, spinny!" snarled Groce. "It's a lousy kilin; and I hate kilin music!"

"Sir?" Esteven appealed to Giles. "You know music, Honor, sir. You've probably had education in it. You can tell the difference, can't you?" Esteven's trembling fingers were snapping time to the music.

"That's right, it's a spinny," Giles said. "But I'm afraid music's not one of my larger interests, Esteven. The Bosser and Singh suits me as well as anything."

He started to move on, but Esteven held up a hand, asking him to wait a moment. Moved by an obscure sense of pity for the man, Giles did.

"I was right, though, sir," said Esteven. "You do know. You do understand. Would you be surprised if I told you the name of the soloist on that spinny? That's me. It's my job arranging and setting up pieces like that. I know I can just program an instrumental part and have it come out perfect from the synthesizer. But there's so few like me nowadays who really know and love their instruments—I always feel you put more into the recording if you have at least a part or two played like that—I mean, if you use a live musician—"

The music stopped suddenly as Groce reached out and stabbed the control button. Bosser and Singh poured forth.

Esteven opened his mouth as if to protest, then closed it silently.

"Groce," said Giles. Groce looked up at him. "That's Esteven's recorder, not yours. Just like your grandfather's book belongs to you, not him. If you don't like what's being played, come and tell me. I don't want you touching the recorder again."

"Yes, sir," muttered Groce, looking down at his cot.

"Give them half an hour or so of what they want," Giles told Esteven, "then take half an hour to play what you want."

"Yes, Honor, sir." said Esteven. The look of gratitude in his eyes was so overwhelming as to be almost sickening. Giles turned to Mara, who was standing just behind him.

"Now," he said. "What was it?"

"If you'll come with me," she said.

She stepped past him and led the

way into the rear section, which was empty at the moment. There she turned to the nearer wall of the hull and the vine on it. She searched among the leaves for a moment, then lifted a stem out of the way with her left hand and pointed with her right forefinger.

"Look at this fruit," she said to Giles, in a low voice.

He stepped close to the vine and brought his gaze down to the fruit she indicated. At first he saw nothing about it that was different from the appearance of the other fruits he had been accustomed to seeing and eating. Then, shading his eyes against the dazzle of the eternal bright lights overhead, he began to make out faint shadows on the *ib* fruit's surface. He stepped closer and saw that the shadows were spots of darkness, seemingly just beneath the skin of the fruit.

"I've seen one or two fruit like this before," Mara was saying quietly in his ear. "But none of them had the number of brown spots this one has. When I ran across it, I did some more looking and found a couple of dozen that have at least two or three brown spots like this."

"Could you show me some of the others?" he asked.

She nodded and led him down along the vine. With a little searching she uncovered three more fruits with a fair number of spots on them, though not as many as the first one she had shown him.

Giles turned back to examining the vine, generally. Superficially, it looked very much the same as it always had; but after a few moments he came across a leaf that was blackened and curled up. He broke it off and went looking for more of the same.

He collected four such leaves, then went back to detach the first fruit Mara had shown him.

"I'll take these to the Captain," he said to her; and looked down at her with approval. "You were wise not to tell any of the others about this before telling me."

She gave him a faint, thin smile.

"Even an arbite has a touch of common sense, Honor, sir," she said.

He could not tell if she meant her tone to be mocking, or not.

"I'll let you know, of course," he said, "whatever I learn from the Captain. I appreciate your coming and telling me about this. Meanwhile, keep it to yourself until I've talked to the Captain."

"Of course," she said.

He turned and left her, heading back toward the front of the lifeboat and holding the leaves and fruit hidden in his hands as he passed through the middle section. His mind was crawling with a vague uneasiness. Naturally, no system as simple as this could be expected to endure indefinitely. While the lifeboats were unused aboard the spaceliner, the nutrient tank would have to replenished at inter-

vals to keep the vine alive and operating. No system was perfect. But his researches back on Earth had told him that it should be good, with the lifeboat carrying a full load of passengers, for six months at least. And those aboard now were far from a full load. He stepped around the edge of the screen hiding the Captain.

The alien officer was sitting in her command chair, her eyes closed.

"Rayumung," said Giles, in Albenareth, *"I need to speak with you."*

She did not answer; nor did she open her eyes. He went closer to her, to the very arm of her command chair. Now hidden behind the screen that protected her, he spoke again, no louder, but almost in the tiny dark orifice of the alien ear.

"Captain! Rayumung Captain!"

She stirred. Her eyes opened, her head turned and she looked at him.

"Yes?" she said.

"I need your attention to a matter," Giles said. *"It concerns the ib vine."*

"The vine is not to be disturbed. Take only the fruit as directed."

"Rayumung," said Giles, *"is your memory failing you? You have never given us directions for using the fruit of the ib. I, from my own knowledge, informed my people."*

"As long as the knowledge has been made available. Act accordingly." The eyes in the dark and wrinkled face closed again.

"I repeat," said Giles, more loudly. *"I must have your attention. There is an emergency about the vine."*

"Emergency?" The eyes opened.

"Will the Captain examine this fruit?"

Giles held the fruit he carried, the one Mara had first shown him. The three long dark fingers of the alien's right hand reached out and took it in their tripodal grip. The Captain held the fruit for a moment, gazing at it, then returned it to Giles.

"Do not eat this. Dispose of it."

"Why? What's wrong with the fruit?"

"It will make you ill. Perhaps you will die. Do not eat such fruit."

"I did not need your advice to caution me about that," said Giles. *"I asked you what was wrong with it."*

"It is no longer wholesome."

"That, too, was obvious." Giles had made the mistake of losing his temper with the alien Captain before this. He told himself he would not make it again, now. His voice, in the buzzing Albenareth tones, was icy, but as controlled as the Captain's. *"Look at these leaves, then."*

He held out the four curled and darkened leaves to the Captain. She took them, held them as she had held the fruit and passed them back.

"The leaves are dead."

"I can see that," Giles said. *"I want to know why. Why are the leaves dead? Why is the fuit not wholesome, suddenly? What has gone wrong with the ib vine?"*

"I have no idea." the Captain's voice was distant, almost indifferent. *"I am a spaceship officer, not a biotechnician. There are those who could tell us what is wrong with the ib, but they are not here."*

"Have you no tests you can make? How about the nutrient solution from the converter? Can't you test that to see if there's anything wrong with it?"

"There is no testing apparatus on board this lifeboat."

"Yes," said Giles, grimly, *"in fact there is very little of anything, aboard this lifeboat. Like all your ships, Rayumung Captain, it is falling apart from old age and lack of proper maintenance."*

He had hoped to prod the Captain out of her strange condition of lassitude and into anger. But the attempt did not work.

"You do not understand," said the Captain, in the same distant voice. *"The ships are dying. The Albenareth are dying. But we do not die as lesser races do. We do not choose to curl in on ourselves and perish in the soup of an atmosphere, to be broken down chemically into the soil, and less than the soil from which we came. It is our choice to go proudly to meet our deaths, one by one, as the further Portal lets us pass, until the race of Albenareth are known no longer. You are an alien and do not understand. You will never understand. The ib vine on this lifeboat, too, is dying—it does not matter why. Since you are dependent on it, you will die also. It is a matter of chemistry and physical law."*

"What about your responsibility to your passengers?"

"I've told you," said the Captain, *"my responsibility is to deliver them—whether they are alive or dead at the delivery point does not matter."*

"I do not believe that," said Giles. *"When you took those of us aboard here, together with the rest of the human passengers who boarded your spaceship above Earth, your responsibility was not indifferent to whether they reached their destination alive or dead."*

"That was then," said the Captain, *"before some one or more of your humans destroyed my ship and cost all Albenareth aboard her great loss of honor. If human actions initiate a logic chain of actions that leads to human deaths, I am not responsible."*

"I do not agree with you," said Giles. *"And in any case, as I have told you, I* am *responsible for the lives of my fellows aboard. You may be able to excuse your actions to yourself; but I warn you, neither I nor any other humans will excuse them—and your race needs the payments in metal and energy my race gives yours, if you want to keep*

these ships of yours running for the next few thousand years—or however long it will take you all to die properly."

"I will not argue with you," said the Captain. *"What eventuates from the arrival of you humans at Belben, dead or alive, must be the concern of others of my race. It is no longer mine."*

"No longer—" Giles broke off, at the stab of a sudden, sharp suspicion. *"Rayumung, is it that you, yourself, don't expect to reach Belben alive?"*

"That is correct. I will not."

Giles stared down at the long, narrow, dark figure in the command chair.

"Why?" he snapped.

The captain looked away from him, transferring her gaze to the nearer of the two screens on the control console before her—a screen showing the endless darkness of space sprinkled with star lights ahead of the lifeboat.

"The ib vine does not have the nutrients I now require," she said. *"Alone, it would nourish me as long as necessary for survival. But I am no longer alone. I carry new life within me—a new life, as yet free of any taint of dishonor, to keep alive the search for the one who destroyed my ship. A new life, if necessary, to found a family line which will never cease from searching until the truth is known. It is a ship's life, bred of the Engineer and myself, but carrying the honor line of all my officers and crew who were with me while my ship lived. I will die, but my ship's child will take what it needs from my body and live to land at Belben, to become a ship's officer and erase the shame of what has happened."*

She fell silent. For a long moment, Giles had no words. All at once it leaped into context in his mind—the elastic ties around the limbs of the spacesuit of the Engineer, that could do next to nothing to protect that alien's life in case of leaks, but which could protect the vital generic area of his central body against the dangers of decompression. That—and what it was that Di had seen, there in the alien blood-marked back of the ship when she had wandered in on the Captain and the dying Engineer.

"But you could have lived if you hadn't done . . . this," he said. *"Why didn't you just survive, yourself, in order to do your own erasing of the shame of what's happened?"*

"I am already dishonored beyond the cooperation of any but members of my own ship's company, all of whom now are dead. But the new life within me, being stainless, cannot be denied cooperation by an other Albenareth without new reason; and that assistance will be needed to find whoever destroyed my ship."

There was another pause between them.

"Very well," said Giles, finally. *"I am not an Albenareth, as you say,*

and I admit I do not fully understand. But I still see no reason why you will not change the course of this lifeboat to 20B-40 and give the rest of us a chance of life. In fact, now I formally insist that you change course."

"No," said the Captain, emotionlessly. *"The life that I carry will be stainless at birth; but more than this is needed. There must be some inherited honor for the young one to ensure its chance at the rank and duty of a ship's officer, which is available only to a few, even among the Albenareth. If this lifeboat delivers what is left of its passengers to Belben, alive or dead, there is that honor . . . otherwise, there is only expediency."*

"There's no honor in saving lives?" snapped Giles.

"How could there be?" said the Captain. *"A life saved by other than that life's owner has only been intruded upon, in its own area of honor—its own responsibility to delay as long as possible the satisfaction of passing through the Further Portal. Also, these are only human lives. If you and your people were Albenareth, you would all gain honor by joining me in the execution of my duty which is to convey them to Belben. As you are not, it makes no difference one way or another. But,* Adelman, *it is to Belben we go and no other destination."*

The Captain closed her eyes.

"Rayumung—" said Giles.

The dark figure did not answer. Giles turned and walked out, leaving the motionless alien behind him.

In the first section of the ship he saw Hem lying on his cot and Mara standing as if waiting. For a second he stared at her, puzzled. Then, with a jolt, memory returned. He had become so involved in his conversation with the Captain he had forgotten that they had been speaking the alien tongue, which Mara of course did not know.

He smiled at her now to reassure her.

"I'm afraid," he said, "the Captain doesn't know much more about the vine than we do. It's not his area of specialty. So, for the present, we'll simply avoid any of the spotted fruit. If you find any like that, pick it and put it directly into the converter. Will you tell the rest about that?"

"Yes," she said. She did not turn away immediately, however, and it seemed to him that she was watching him a little curiously. "That was all you were able to find out, in spite of talking to him so long?"

"The Captain and I always seem to have a bit of an argument whenever we talk," he said. "I'm afraid I didn't learn anything else worth telling you. But I'll be talking to the Captain again; and as soon as I have some information to pass on, I'll pass it on. But for now, just avoid the spotted fruit as I said;

and don't worry. Tell the others that."

"I will," she said.

She turned and went back into the middle section of the ship and he heard her voice; although, with the recorder running in the background, as it was more and more constantly now, he could not make out exactly what she was saying to the rest. Gradually the sound of the recorder was coming to be used as a privacy tool; and as such it was welcome.

Giles lay down on his cot and gave his thoughts over to the problem of the Captain. One way or another, their course must be changed to a destination of 20B-40—and the change must be made while the Captain was physically still able to make it.

8

Sixth Day—23:57 hours

The humans, except Giles, were all asleep. Although the lights still blazed eternally overhead, they had all fallen into a pattern, a sleeping and waking cycle. At about midnight, lifeboat-time, Giles sat murmuring into the recorder to log the day before trying to sleep himself.

"Sixth day," he dictated. "There's still enough fruit, but the numbers of those with spots are increasing. More leaves dying. Morale, about the same. This is the end of the sixth day."

He put the recorder safely away on the floor at the head of his cot, where Esteven could come and get it in the morning, and reached for the sleeve he had cut from his shipsuit. The orange-colored sleeve, from wrist to shoulder, was long enough to make a workable blindfold with its two ends tied behind his head—enough to keep the light out so that he could sleep more easily. He had no way aboard the lifeboat of seeing himself reflected, but he could imagine how his one bare, exercise-muscled arm and his curly, six-day beard gave him a wild, almost barbaric look. Curiously, none of the arbites had such a look. Though Groce and Esteven both were sprouting considerable beards—touched with a few gray hairs in Groce's case—they looked disheveled and unwashed, rather than wild. Frenco and Hem, on the other hand, had no beards to speak of. Frenco's consisted of a few limp black hairs scattered sparsely over his lower features. Hem had a faint fluff of blond mustache and some sandy stubble following the line of his jawbone on each side from chin to upper cheeks.

Nearly all of them now, except Biset, had sacrificed at least a small part of their clothing to make a light-shield for their eyes during sleeping hours. He could hear them breathing slumberously beyond the screen, now. Luckily none of them were snorers of any heaviness or regularity, although Hem occasionally rolled over on his back and fell into a deep rumbling snore.

Giles wrapped his loose sleeve around his head and tied it, then stretched out on his cot. He waited for sleep . . . but it was slow coming.

At moments like this he became actively conscious of the closeness of the surroundings, the thickness of the atmosphere, and all the unresolved problems that stood between them and a safe planetfall on 20B-40, to say nothing of those standing between him and the successful completion of his mission. He turned over restlessly on the cot, looking for a more comfortable position. Even assuming the *ib* vine held up and they could make the course change to 20B-40, could the arbites stand up to another thirty or forty more days like this?

Something intruded on his thoughts. Something barely heard, like a cry cut off before it had actually had time to clear the throat of the one crying out. He listened . . . but he heard nothing.

He continued to listen. There was no sound but the nighttime heavy breathing—even Hem's approximation of a snore was silent. And in addition to those noises there was nothing . . . or was there?

He sat up on the cot, pulling the sleeve from his head. The bright light overhead burst on his eyes in its full strength. Through the dazzle of it as his vision adjusted, he identified what he thought he had been hearing—a quiet thudding from the very bow of the ship.

He got to his feet, his sight clearing. The thudding was coming from behind the screen that hid the control console of the lifeboat and the Albenareth Captain. He stepped forward, turned the end of the screen—and saw the alien choking the life out of Esteven. The man's face was dark, his hands plucking feebly at the alien fingers fastened with casual power around his throat, his kicking heels making the almost inaudible noise Giles had heard as they drummed upon the fabric-covered flooring.

Giles threw himself at the Captain.

"Release him!" he shouted in Albenareth, tearing at the Captain's fingers. It was like trying to pull steel rods loose. *"Let that man go! You're killing him!"*

"I am in process of disposing of him," said the Captain coldly, continuing to choke the entertaincom. *"He has profaned the Book of Navigation and should be removed from our midst in the interest of honor."*

"You do yourself dishonor!" raved Giles. *"He is not yours to dispose of. You take something to which you have no right! He is my man—mine to keep or mine to kill—not yours! You are a thief, without honor!"*

The reaction was instantaneous. The Captain literally dropped Esteven, who fell gasping to the floor. The Captain's hands were up, her

long fingers now directed toward Giles, who braced himself to face attack by the alien.

But the hands dropped. The Captain turned from Giles and dropped into her command chair, to gaze at the forward screen.

"Take him, then." The Albenareth's voice was cold and indifferent. *"He has dared to touch and turn the pages of our Holy of Holies. Do with him what you want. Only, if I see him in the forward part of the lifeboat again, I will consider that one who cannot control his property lies about his rights to it."*

Giles pulled Esteven to his feet, lifting him bodily into the air, slapping aside the feeble efforts of his hands when the entertaincom tried to resist, then shoved the man ahead of him, out of the Captain's area, through the first section of the lifeboat and into the middle section.

The other arbites had crowded into the first section, awakened by the sound of the loud voices in Albenareth. They rolled back now like retreating surf before the approach of Giles with Esteven, into the middle section. When Giles with the other man had joined them there, he shoved Esteven into their arms, beckoning Mara to him. She hesitated, and in exasperation he reached out a long arm and literally hauled her close enough to him so that he could speak to her in tones too low to be heard by the Captain up front.

"Take care of Esteven," he told her. "The Captain was choking him, but he'll be all right."

"What—" began Biset, demandingly.

"I've just saved his stupid life—keep your voice down!" whispered Giles harshly. "And I don't guarantee to be able to save any more of your lives, unless you follow orders. Now, do what I say; and don't let Esteven beyond that screen into the front of the ship if you value his life!"

He let her go and turned away. Behind him, Esteven had slumped to the floor and was sobbing.

". . . I didn't mean anything wrong. I couldn't sleep. I thought it was just a book—to read, to look at, you know—"

Giles went back into the front section of the ship, followed by Hem.

"Hem," he said to the big arbite, "keep them back there. I've got to do some thinking."

Hem nodded and stood in the doorway. Giles threw himself down on his cot. Now, on top of everything else, he had the puzzle of Esteven. Not for a second did Giles believe that the entertaincom had merely wanted to look at the Navigational Book. And to actually step into the private area of the Captain would have taken courage Giles would have been ready to swear Esteven did not have.

On the other hand, what could the entertaincom have been hoping to gain from getting at the Book? The Albenareth mathematics would have meant nothing to him—and the navigational manual would have no white spaces such as Groce's antique math book had owned, on which Esteven could play at writing music.

The recorder had started up with the familiar Bosser and Singh in the middle section of the lifeboat. The puzzles in Giles' mind seemed to go up and down, around and around, with the repetitive melody of the music . . .

He woke suddenly to the awareness that he had dozed off. Hem was looming over his cot.

"Mara wants to talk to you, Honor, sir," Hem said.

"Oh?" Giles sat up, rubbing his eyes into the clearer vision of full wakefulness. He became aware that Mara was standing in the entrance through the screen as if before an invisible barrier.

"Sit down," he told her, motioning to the end of his cot. "Save your strength. We all need to save what strength we've got."

She hesitated for perhaps a second. He could not tell. Then she sat.

"You're right, of course," she said.

He smiled. It was one of the unlikely sort of things she had a habit

of saying—certain statements or questions that, if they had not been said so innocently, would have been impudent. It was not up to an arbite like herself to pass judgment on the correctness of what he said. He remembered what he had thought of her shortly after he had first noticed her.

"Tell me, Mara," he said. "You didn't happen to grow up in the household of some Adelborn family, did you?"

"Did I—?" she laughed. "Far from it. My father died when I was only three. There were eight children in our family—a computer error gave my parents a permit for that many offspring and they didn't realize it was an error until too late. Then, as I say, my father died; and my mother got special permission to devote all her time to bringing up her family—she even got permission to move my grandmother in, to help, so I actually grew up almost as if I'd lived a hundred and fifty years ago, before the Green Revolution."

He gazed at her, surprised.

"Weren't you enclassed?" he asked.

"Oh, I had to take the usual courses," she said. "But with a family as large as ours, whenever I was home we were in an environment of our own making. A regular old medieval family-type environment."

"Yes," he said. He felt a terrible pity for her. No wonder a girl like this could fall into the trap of joining an organization like Black Thursday. For a second he was almost tempted to warn her that Biset had identified her as a revolutionary. But the habit of duty silenced him.

"What was it you wanted to talk to me about?" he asked.

She glanced at the entrance to the middle section of the lifeboat, but the recorder was putting out enough sound there so that she did not have to lower her voice unduly to speak privately to him.

"It's about Esteven," she said. "I thought you'd want to know. I'm not a licensed nurse; but when I was in secondary school I put in a year full-time as a probationer in the medical services. I had the usual courses. There's something wrong with Esteven physically. His hands are ice-cold—here in this thick steam-bath air of a lifeboat; and his pulse is rapid and erratic."

He looked at her with respect.

"That's good—your noticing that and coming to tell me about it," he said. "I don't suppose you've got any idea what could be causing symptoms like that?"

She shook her head.

"As I say," Mara said, "I was only a part-time volunteer worker for a year, and back when I was hardly grown, at that."

Giles nodded.

"Of course," he said. "Well, it's something I'm glad to know about. I'll try talking to Esteven himself

and see if he knows what's wrong with him."

"Not that we can do much about it, whatever it is," Mara said, "on an alien lifeboat with no medical equipment or drugs. I don't know what to do."

She sounded to Giles as if she were genuinely upset.

"It's not your responsibility to do anything," he reminded her gently. "I'm the one who's responsible."

"Oh yes," she said, waving one hand as if to brush that statement aside. "You're an Adelman and you think you ought to take everything on your own shoulders. But you're stuck here with a bunch of arbites; and what do you know about arbites?"

"What do I—" he began to repeat in astonishment, and checked himself, hearing the long-ago echo of Paul Oca's voice saying almost the same thing to him. The astonishment carried him past what would have been an ordinary, instinctive refusal to discuss such a ridiculous charge with her. "Aren't you the arbite who told me how all the lower classes dreamed of a chance to go indent to one of the Colony Worlds—"

He broke off and glanced over at the other cot in the front section of the ship. But Hem was not there, nor was he in view in the middle section. Hem did not spend much time in the middle section anyway. If he was not up front, he was probably back harvesting the vine or collecting the fruit he would eat himself. Nonetheless Giles lowered his voice.

"Just the other day," he went on, "I had a long talk with Hem. Hem's miserable at being shipped away from the work-mates he used to know. He'd give anything to go back to Earth. Perhaps I know more about arbites than you think."

"Oh, Hem!" said Mara. "It's immoral, the way poor, helpless children like him are gene-controlled to grow up as hardly more than animals—"

"Shh!" he said, genuinely alarmed for her. "Keep your voice down. Someone aboard might decide to report you."

Mara did lower her voice; but the tone of it was still scornful.

"You mean the split?" she said. "I'm not afraid of her!"

"Split?" he echoed.

"The Police agent," said Mara. "Biset."

"You . . ." he studied her, unable to believe it, "already know she belongs to the Police?"

"Of course," said Mara. "Everybody on the spaceship knew it. There's always one. The World Police send an agent out with every shipment of indents. Any arbite knows that."

"What else do you know about her?" he asked.

"I know she's likely to report anyone she doesn't like, whether they've done anything or not. If she

decides she doesn't like me she'll dream up some reason to report me."

He gazed at her gravely.

"The possibility doesn't seem to worry you much," he said.

"The word is they don't pay too much attention to Police agents like her out on the Colony Worlds when they turn in bad-conduct or revolutionary-talk reports and minor charges like that," she answered. "They've had too many Police Agents coming out with shipments and trying to cause trouble before they're shipped back to Earth again."

"I think her accusation might be a little more serious than that." Suddenly Giles threw his sense of duty to the winds. Bisets were a dime a dozen—this girl, with her straightforwardness and courage, was a jewel among the stones of the gravel pile that was the arbite lower class. "She might accuse you of being one of the Black Thursday revolutionaries."

She looked at him.

"Oh?" Mara said.

Without warning, an invisible barrier had raised itself between them. They were no longer two people sitting together, they were opponents facing each other across a strip of disputed territory. Giles felt a powerful urge to break down and do away with whatever was separating them—the power of the urge surprised him. But he had no time to examine the emotional angle of the situation, now.

"She told me so," Giles said. "I didn't really believe it."

"That's good of you, Honor, sir," said Mara. "Of course, you're right. I'm not."

"I didn't think so," said Giles.

But the barrier was still there, in place between them.

She got to her feet. "Thank you for telling me, though, Adelman."

"Not at all," he said, formally, helplessly. "Thank you for telling me about Esteven."

"I wanted to help," she said.

She turned and walked out. He let her go. There was a strange anguish inside him, at seeing her leave like that. He could not understand what had gone wrong.

It was some hours later, when the recorder was playing loudly in the middle section, that he looked up to see Biset—standing by his cot. She spoke to him without preamble, in Esperanto, as soon as his eyes were on her.

"Forgive me, Honor, sir," she said, with no tone of an actual plea for forgiveness in her voice at all, *"but I'm afraid I have to speak to you. I've warned you once about the girl, Mara, and her revolutionary connections. I must remind you now that your rank doesn't exempt you from the authority of the Police. You've been giving this girl a good deal more license than you should."*

"She came to tell me about—" Giles broke off. He had been about to tell this woman how Mara had

come to inform him about Esteven's possible illness; and then it dawned on him that he was condescending to explain himself to her. A cold fury erupted in him.

"Get out!" he snarled.

He rose to his feet on the physical impulse of his own rage; but by the time he was fully upright, Biset was gone. He felt the pounding of his own heartbeat, marking its pulse in the big artery under his chin.

He strode back through the screen entrance into the middle section of the lifeboat and caught a glimpse of Biset in a corner, staring at him with widened, white-encircled eyes as he went by. Mara was not there. He stopped by the recorder long enough to turn it nearly to full volume with one twist of his fingers, then went on into the rear section. Di and Frenco were there, and so was Mara, picking spotted fruit from the vine and putting it into the converter.

"Leave us," snapped Giles to Di and Frenco. They stared at him and hurried to leave the rear section.

He was alone with Mara. She turned to stare at him, puzzledly, as he came up to her.

"Biset," he said. Standing face to face with her, inches apart, it was just possible to make himself heard over the sound of the recorder while speaking in a normal tone of voice. They were entirely private under the noise of the music. "She came to see me just now with the damned effrontery to suggest I shouldn't talk to you."

Mara opened her mouth.

"Perhaps—" she began in the same formal tone on which they had last parted; but then her face and voice changed to a tone and expression of concern. "Perhaps . . . you shouldn't."

"I?" he said. "I'm Giles Ashad of *Steel.* Never mind that. There was something I should have mentioned to you. I should have told you that if Biset tries to make trouble for you—in any way—you come to me. I suspect she may try to accuse you of being the one who planted the bomb that blew up the spaceliner."

Mara stared at him.

"It actually *was* a bomb, then?" she said. "How can she or you or anyone be sure about that?"

"She can't," said Giles briefly. "I can. I was the one who planted it there." Giles' teeth ground together with the pain of the memory. "It wasn't intended to hurt anyone; and it certainly wasn't intended to destroy the spaceliner. It was only supposed to damage it at a particular point on its trip, so that it would have to turn aside to the closest planetfall—a mining colony world called 20B-40—for repairs."

For a second she only stared at him.

"All those lives . . ." she said. Then she changed and came forward to put her hand on his arm.

"But you said you didn't mean to hurt anyone. What went wrong?"

His jaw muscles ached. He was suddenly aware his teeth were clenched together. He parted them with an effort.

"I don't know!" he said. "I suppose like a damn fool—the damn fool I was, and we all were—we underestimated how rotten with age some of these Albenarthian spacecraft are. The bulkhead that ought to have contained the explosion, back there among the cargo, must have split wide open and the fire started—you saw it."

Her grip on his arm increased. She stared up into his face. "Why are you telling me all this?" she said.

He looked at her grimly for a moment.

"Perhaps," he said, slowly, "because I trust you. I don't know why—I couldn't explain to anyone why. But just now I suddenly began . . . suddenly I had to tell someone; and you're the only one I could bring myself to open my mouth to."

He saw her looking at him now in a way no one had ever done before. It disturbed him and, in an odd way, made him feel humble. He had never suspected that a woman might look at him just that way. There were things he found he wanted to say to her; but a lifetime of training and discipline closed his throat when he tried to utter them.

Clumsily, he patted the hand with which she was holding his arm, and turned away. She released her fingers, letting him go. He went back through the middle section of the lifeboat, pausing for a second to turn the volume on the recorder down to its previous level. All the other arbites there were staring at him and among them was the face of Biset.

He ignored them, going on into the front section and lying down on his cot, on his back. Throwing the loose sleeve across his eyes, he abandoned himself to the privacy and loneliness of artificial darkness.

9

Tenth day—11:22 hours

Di was crying. Sitting on her cot and crying. For a while after her experience with the Captain and the dying Engineer in the rear section of the lifeboat, having one of the other women with her had comforted her. Then she had seemed to get better, and it was the presence of Frenco which soothed her when she woke from one of her nightmares. But lately, nothing helped. She cried frequently and could not say why.

"What can I do?" Frenco asked. He was standing with Giles and Mara in the rear section, Di had just thrust him away from her when he had tried to sit down beside her.

"I don't know," said Giles, thoughtfully, looking at the girl.

"Obviously she needs medical help. Just as obviously, none of us are equipped to give it to her. Don't blame yourself, Frenco—"

"It was my idea to apply for indent to a Colony World!" Frenco said wildly. "My idea. The odds were a thousand to one against our getting it; and when we did, we couldn't believe it, we were so happy. Now—"

"The word I used," said Giles, "was *don't.* Don't blame yourself. This depression of Di's could have one of any number of causes. It could be a result of the food, or a result of the atmosphere aboard. It could be something generic in her that would have cropped up even back on Earth. But we'll stay with her and do what we can for her. Call me if there's any help I can give you."

"And call me," said Mara to the boy, "any time I can help."

"Thank you," said Frenco. But he said it wearily, like someone who has worn out hope.

"Brace up!" said Giles to him, sharply. It was the same hard, sensible advice he would have given another Adelborn; but then Frenco cringed, and Giles remembered he was speaking to an arbite. He softened his voice. "If we can get her alive to planetfall, she'll be all right in the long run."

"Yes, sir," said Frenco. He made an effort to put some life back into his words and some animation into his posture.

"That's right," said Giles. "Why don't you leave her to herself now. You can see she'd rather be left alone—and you could use some rest. Come up to the front section and take my cot for a while."

Frenco looked at him gratefully.

"Thank you, Honor, sir," he said. "But you're sure—you think I can't help her at all by being here, even if she acts as though she doesn't want me?"

"I'm sure," said Giles. "Everyone else on board will be keeping an eye on her for you."

Frenco nodded.

"Yes," he said. "Thank you. Thank you all . . . I guess I will go and lie down up front, just for a bit."

He went out.

Giles turned his attention to Mara.

"Have you been eating?" he asked. "You look as if you're losing weight."

She gave him a wraith of a smile. "We're all losing weight," she said.

"I don't see how we can last another eighty days to reach Belben, if we and the vine keep going downhill like this."

"Yes . . ." Giles felt the sudden ache in his jaws that signaled he was clamping his teeth together again too fiercely. The gesture was becoming a habit with him lately.

"What is it?" Mara was looking at him.

"Something . . ." he looked at

Di, but Di was beyond listening—lost in the dark night of her own misery and the sound of her own weeping, added to the music sounds from the recorder in the middle section that would keep anyone else from overhearing. "You know I said the plan behind my bomb was to turn the spaceship aside to 20B-40?"

"I remember."

"There was a critical period," he said, "a maximum number of ship days during which such a change of direction would be practical. The period of days began the day the bomb went off. I've been counting the days since. We've got no more than six days. After that it'll be too late to change course. We might as well continue on to Belben."

Her eyes were big. Or perhaps it was just the new thinness of her face that made them seem so.

"How close is this 20B-40?"

"Now?" he said. "About thirty days away."

"But we could hold on another thirty days!" Mara said. "I don't understand—"

"The Captain's refused to change course from the one set for Belben," he said. "There's no use my trying to explain to you why. I don't really understand it myself. Just take my word for it that it has to do with honor in the way the aliens see it."

"But what's wrong with him? Certainly just honor—"

"It's not a *him,*" Giles said. "That's something I've been keeping to myself from the first so as not to scare the arbites—" he broke off with a short, harsh laugh. "Do you know, I'm beginning to forget to think of you as an arbite? We're all getting down to a basic common label of 'human animal' on board this boat. —No, the Captain's a female. Not only that, she's pregnant. The Engineer was the male parent, just before he died; and it must have been their . . . mating . . . that Di stumbled in on, back at that time she can't remember."

Mara drew a deep breath.

"Oh . . ." she said.

"The fact that the Captain's pregnant ties in somehow with the matter of Albenareth honor, in taking the lifeboat to its original destination; even though all of us—and she, too—are going to die before we reach it."

"But if she dies, what about the—the child?"

"It won't die. It lives on her body, somehow." Giles waved the matter aside. As with the matter of the bomb, he felt immeasurably better just from having been able to tell someone else about the Captain, her pregnancy, and 20B-40. "At any rate, what it all adds up to is that I've got to find some way of convincing the Captain she has to change course to 20B-40 inside of the next six ship's days."

Mara shook her head.

"I still don't understand," she

said. "Why can't we just take over and make the course change ourselves? I know these aliens are awfully strong, but there are eight of us and only one of her—"

He smiled at her a little sadly.

"Do you have any idea what changing course means?" he asked.

"No," she said, "to be honest, I don't. It's a matter of using the controls up front a certain way, isn't it? But didn't you have to study the Albenareth and their ships in order to figure when the bomb needed to be set off? So don't you know how to work their controls?"

"The controls are no problem," he said. "The problem is calculating a new course that will bring us to 20B-40 and figuring the changes in the present course that will put us on that new one."

"But there's Groce and his compute," Mara said. "Groce could help you with any figuring you needed to do—"

She broke off at the shaking of his head.

"Why not?" she asked.

"I'm sorry," he said. "But you really don't have any comprehension of what's involved in interstellar navigation. The manipulation of the controls is simple; and the mathematics of course calculation can be performed by Groce's compute, all right. But navigation out here between the stars is a science by itself. It calls for a mind trained in that science, and preferably one that's already done some navigation."

"But what about you? You're an Adelborn, and lots of them have yachts they pilot themselves between Earth and the other planetary bodies of the Solar System. Haven't you ever done anything like that before?"

"A few hundreds of times," he said. "But interplanetary yachts like the one I had are preprogrammed with a great deal of information that out here would have to be worked out from scratch. The first problem in interstellar space is to find out where you are . . . and it builds from there. No, if the course change is going to be made, the Captain is going to have to be the one to do it; and she's going to have to do it while she's still alert enough to manage it. She's been getting less and less active, and more withdrawn and indifferent, lately. I think from what she says it's that 'new life' she talks about inside her, draining the nutrients it needs from her."

Mara's jaw was at a stubborn angle. "There must be some way," she said.

"No. It has to be the Captain. Why don't you get some rest, and leave me to work with the problem?"

"I can watch Di. That'll leave you free to think."

He shook his head again. "Watching her doesn't interfere with my thinking," he said.

She got to her feet slowly. "Call me, though, the minute you need help."

"I will."

He watched her go through the entrance in the rear screen, into the middle section and out of sight. There was a weariness inside him that tempted him strongly to lie down, to stretch out horizontally, if only for a few minutes; but he knew better than to give in to it. Flat on his back, he would not be able to resist the desire for sleep that lately seemed to be plucking at his sleeve most of the time.

He must keep his mind alert and on the problem. There was a solution to any reasonable situation. The Captain's objection to the course change was difficult only because it was involved with alien psychological and social factors. If there was only some way to give the Albenareth female what she wanted, without in any way sacrificing human lives or interfering with his own duty . . .

He came awake with a start, to the realization that someone was standing almost at his left elbow.

He turned to look. It was Esteven.

"Sir, sir . . ." Esteven's voice was hoarse. His face was gray and sweating under the merciless light from the overhead lamps.

"What is it?" demanded Giles.

"I . . ." the words seemed to take more effort to pronounce than Esteven had to give them. "I need help, sir. You . . . you will help, Honor, sir?"

"Of course, if I can," Giles said. "Sit down, man, before you fall down."

"No . . . no, thank you, Honor . . ." Esteven swayed. "I must have . . . it's just a request, a small one. But necessary . . . indulge me, if you will please, Adelman. You know I . . . the Captain . . ."

"What are you trying to tell me?" demanded Giles. "Pull yourself together. Talk plainly."

"It's just that I need . . . Do you, Honor, sir, have . . . a piece of paper . . . in your wallet, maybe?"

"Paper? No I don't even have a pad or stylo—" Giles broke off, looking at the other man narrowly. "This isn't that music-writing you keep talking about, is it? Why—"

"No, sir! No, Honor, sir!" The denial was a cry from Esteven's colorless lips. "I can't explain. But I have to have some paper. Just to touch. Just to look at. Please, please . . ."

The real pain in Esteven's voice was undeniable. Instinctively, Giles began plunging his hands into the various pockets of his shipsuit. He came up with various odds and ends, but nothing made of paper. Paper was almost a collector's item, on Earth at least, nowadays. Only on the Colony Worlds was there much paper manufactured. How Esteven expected Giles, here on this alien lifeboat, in just the

clothes he stood up in, to produce a collector's . . .

Of course! Giles dug out his identity card case from a right trouser pocket. Behind the card was a souvenir folded banknote issued sixty years before by a small African country, before the last of the independent currencies had been done away with in favor of the International Credit Standard. Esteven snatched at it; but Giles pulled it back from the other's trembling fingers.

"Wait a minute," said Giles, sharply. "You said you just wanted to look at it, to touch it."

"To feel . . . to hold. If I could just keep it a little . . ." Esteven's mouth was becoming wet at the corners from escaping saliva. His lower jaw was making odd, chewing motions. Giles stared at these things, at the popping eyes and the strange gray pallor on the man's face and suddenly the truth jumped into the conscious area of his mind.

"Tonky!" Giles reacted instinctively, snatching the banknote back out of Esteven's reach; and the cry from Esteven at the loss was proof enough. "A tonky-chewer! I've heard about the drug—one of the pseudohallucinogens, isn't it? You take it and nothing seems real after a while. So that's what's been at you!"

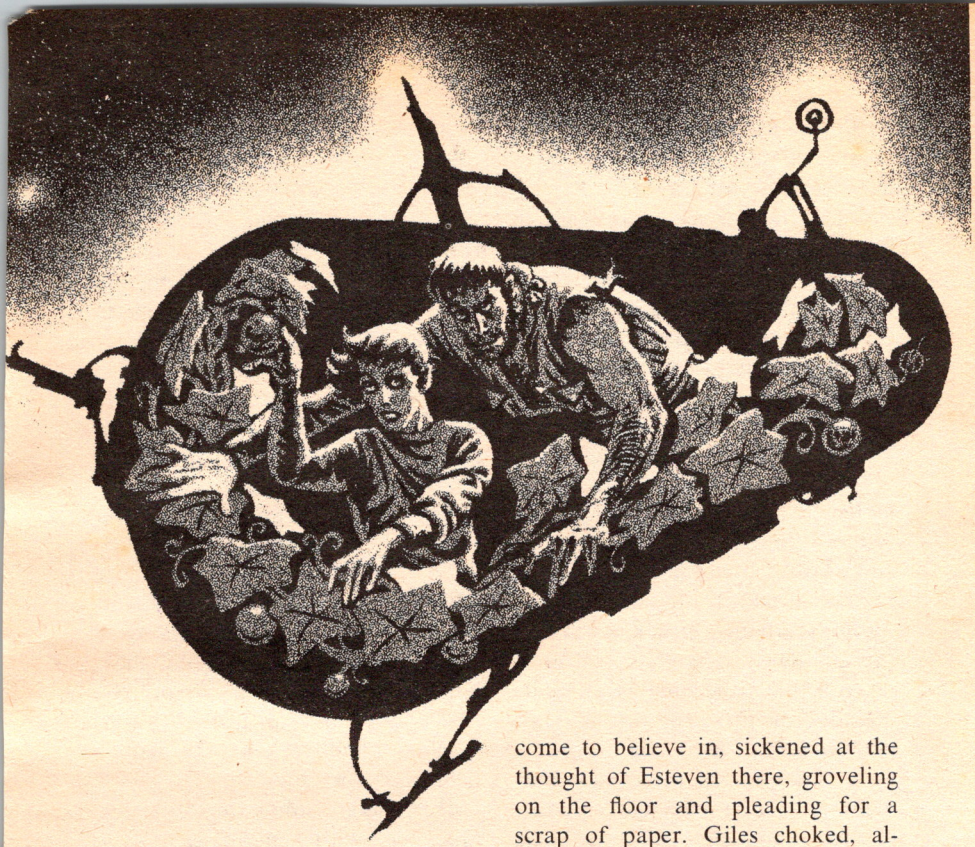
"Honor, sir . . ." Esteven was trying to crawl over Giles, to get at the hand with which Giles held the banknote behind him. The entertaincom's chin was wet all over now with saliva. "Please . . . you don't know what it's like! Every little wrong sound hurts. It hurts to move, even—"

Giles shoved the man away. It was like shoving away a child. Esteven seemed strengthless. He tumbled back from the cot to the floor and crouched there, panting.

"Be sensible," said Giles, coldly, although inside he was moved as much as he was sickened by the sight of the man in this state. "Even if I gave you this banknote, it'd only do you for one or two more doses and we've got weeks yet before we reach a planet where you could get more paper. And the tonk has to be taken with paper, doesn't it? It has to be buffered with some cellulose or else it can hit hard and kill you. How did you get started taking a poison like that in the first place?"

"What does an Adelman like you know?" Esteven almost screamed at him from the floor. "I can play thirty-two instruments, but who wants to listen, nowadays? So I'm an entertaincom, I arrange and play moron-tapes of moron-music to moron-arbites; and that's my life, all the life I have. All the life I'll ever have—on Earth or out in the colonies. Oh, please, just give me half of the paper . . . just a scrap of it to go with the bit of tonk I've got left—"

"No." Giles got to his feet, putting the banknote back into his



pocket. "I can't help you to do that sort of damage to yourself. I won't help you. You're going to have to face life without the drug in a ship's day, anyway—so face it now!"

He strode off, through the opening in the screen beside him, headed for the forward part of the lifeboat, away from the mewling pleas in Esteven. Inside himself, it felt as if a huge, cruel hand had just gripped his intestines and twisted them. Everything that he had learned in those years of his growing up, everything that he had come to believe in, sickened at the thought of Esteven there, groveling on the floor and pleading for a scrap of paper. Giles choked, almost gagging. He could not crawl and whimper like that—no matter what any drug, man, or alien should do to him. Anything would be preferable to such a state.

He passed through to the forward part of the lifeboat and began to pace back and forth, there was no end to problems. Now that he knew what was wrong with Esteven, it was necessary to decide what to do to help the man. Obviously Esteven was going to have to do without the drug—and, with luck, that would break him of his dependence on it. But he would

undoubtedly need attention and care while he was going through his period of withdrawal . . .

Giles frowned, trying to recall all he knew about the drug—one of the illegal toxics made and circulated in the arbite social ranks. It was, if he remembered rightly, a purely synthetic drug, originally developed as an aid to psychiatric treatment, before its dangerous and addictive side had been understood.

It was a complex, long-chain molecule that affected the nervous system directly, causing poisoning and death if it was not absorbed by the system slowly. It had an affinity for carbohydrates and any of these slowed down its action if taken at the same time as a minute quantity of the drug in its gray, powder form. Plain cellulose in the form of paper was the most convenient and most effective carbohydrate to companion a dose. Tonk, taken and chewed slowly with paper, reacted with its molecules locking on to the carbohydrate molecules, and was absorbed by the body chemistry only very slowly, over a matter of hours or even a couple of days. That meant that a little of the drug must go a long way. It must also mean that the body of an addict ended up having some trace of the drug lingering in his system most of the time . . . and deterioration, both mental and physical, would be swift under those conditions.

The *ib* fruit was high in protein and low in carbohydrates. Those carbohydrates it did have were easily and quickly digestible, of little use in slowing down the effect of tonk taken with them. This explained Esteven's attempt on the navigation book earlier. The pages of that book were made of vegetable fiber—

A wailing sliced through his thoughts. He jerked his head up to stare through the opening in the nearer screen.

Esteven was coming toward the front of the lifeboat, his mouth open with a long rope of saliva pendant from it, keening the sound Giles had just heard, over and over again, breaking off only to chew and swallow, and wail again. His hands were out in front of him, reaching blindly. Plainly, he neither heard nor saw Giles.

He's taken some of the drug, Giles thought, taken it raw.

Even as he was thinking this, he was on his feet and headed back through the middle section of the lifeboat to meet Esteven.

"I'll help you," he called to the drugged man. "Hold on. We can do something—"

Staring eyes in Esteven's face glared right through him. Giles reached the man, grabbed him by the shoulders and hurled him backward. For a moment, Esteven resisted with a strength that was unbelievable. Then he staggered back against the *ib* fruit press. His outflung left hand closed on the

handle of the press, jerked at it, and the rust-eaten handle snapped off short, leaving a long length of it like a jagged-ended club in Esteven's hand.

He came forward again, still wailing, swinging the club with an overhand motion. Giles dived forward, trying to get under that swing, but he was only partly successful. The club glanced off the side of his head. Still struggling to keep his feet, he reeled sideways into a roaring red darkness on the very edge of unconsciousness.

Vaguely, he was conscious of Esteven going past him.

"Book . . ." croaked Giles to the other humans. "The Navigation Book! He's after it . . . stop him!"

His head was clearing now. But he saw the arbites of the middle section making no effort to stop Esteven. Instead they were scrambling out of his path, trying to stay as far away from him as possible. Giles got his half-stumbling body under control and lurched after the madman.

Hem appeared in the opening of the first screen. Esteven swung the club again; and Hem made a heavy, grunting noise, as the metal length thudded against his right upper arm, knocking him aside. Beyond Hem and in front of the book on its jewel-bright stand appeared the tall, lean, dark figure of the Captain.

"No, Esteven!" cried Giles, plunging forward. But he could not catch up with the man before Esteven reached the alien figure barring his way. A third time, Esteven struck with the club.

There was no room to dodge. A human could not have escaped being struck. But the Captain swayed, bending her body in a sudden and gracefully serpentine arc to one side, so that the club whistled by, missing her by inches. At the same time her right hand shot forward, not clutching, but striking, the three long fingers clustered together to form a solid-ended rod that drove into Esteven's chest.

The force of the blow knocked the human backward, off his feet. He dropped the club and lay for a second, apparently fighting for breath. Then he managed another choked wail and scrambled to his feet. Obviously, he had been hurt, at least the breath knocked out of him and possibly ribs were broken; but under the influence of the drug he was still moving. He lurched once more blindly toward the Navigation Book.

The Captain was waiting for him. But before he could reach the alien, who still stood barring the way, Giles caught up with him from behind, caught him around the body and hurled him off his feet. The Captain stepped forward; but now it was Giles who barred the way.

"No!" shouted Giles, in Basic. He switched to Albenareth. *"I for-*

bid it! He doesn't know what he's doing!"

"This time I end him," said the Captain. She faced Giles and her powerful fingers were aimed at him, now. *"I gave you warning."*

Esteven was starting to scramble up from the floor, but now Hem was looming over him. Hem raised his left arm, the heavy fist at the end of it balled into a rock-like shape aimed to descend on the nape of Esteven's neck.

"Don't kill him!" Giles shouted at Hem.

The blow from the big arbite was already started. Somehow, he managed to turn it slightly off target. It hit high on the back of Esteven's head, instead of in the vulnerable spinal area.

Giles turned back to the Captain, just as she started to brush him aside. *"No! Wait. Think. You are more powerful than any one of us, but what of all of us, together? If you have no fear for yourself, what of the new life you carry in you? Will you risk what all of us together might be able to do to it?"*

The Captain checked herself, inhumanly, in mid-motion; and was suddenly as still as if she had never intended to move.

"I know his sickness now," said Giles, swiftly. *"I did not before. Now I can guarantee he will not come forward in the lifeboat or threaten to touch your Book."*

Still, the Captain did not move. The adrenalin that had kept Giles on his feet since he had been hit on the head by the metal handle was beginning to die within him. He felt consciousness seeping out of him.

"Believe me!" he said, urgently. *"It is one or the other. I will not let you kill one of my people!"*

For a second Esteven's life, and perhaps the lives of all the rest of them, hung balanced. Giles forced himself to stand upright, to stare into the Captain's dark, unreadable eyes—within he prayed that the Albenareth would not realize how badly Giles himself was hurt, how Hem was one-armed now, how the other arbites would be like rabbits facing a wolf without Hem or himself to spearhead an attack.

"Very well," said the Captain, stepping back. *"One more time I give you the life of this one. No more."*

She turned and disappeared behind her screen. Giles turned, fainting, to find himself caught by half a dozen hands, Mara's and Biset's among them.

10

Fifteenth day—16:19 hours

"Feeling any better?" Mara asked.

"I suppose so," said Giles—then reproved himself silently for giving such a grudging answer. "Nonsense. I'm a lot better. Fine, in fact."

"Not fine," said Mara, looking at him keenly. "I know better than that. But you're going to live, anyway."

"Live? Of course I'll live. Why wouldn't I?" he said stiffly.

"Because you probably had a concussion," she said. "When metal and bone come together, it isn't the metal that gives."

"Well, never mind that," said Giles. He touched his hand to his bandaged head, pleased in spite of himself by the fact someone cared how he felt. "I have to admit things have been kind of hazy of late. How long was I . . ."

He fumbled for a suitable word.

"How long have you been like this?" she said. "Five days."

"Five days?" he stared at her. "Not *five* days?"

"Five," she said, grimly.

He was beginning to feel the effort of talking. He lay still for a second, while she did something or other down near the foot of the cot on which he was lying.

"This isn't my cot!" he said suddenly, trying to sit up. She pushed him back down. He was in the rear section of the lifeboat.

"Rest," she said. "Lie still. We brought you in here because we didn't want the Captain to see how helpless you were."

"Good," he said, staring at the lights overhead. "That was wise."

"Sensible."

"All right–sensible." He began to remember things. "How's Hem?"

"All right," she said.

"His arm wasn't broken? I was afraid."

"No. His arm is just bruised. He's got bones like a horse."

Giles sighed with relief.

"Esteven–"

"Two broken ribs, I think. We had to tie him up for a day or two, while he went through withdrawal from the drug," Mara said. She came up near the head of his cot and handed him what seemed to be a small plastic envelope with a few tablespoonfuls of gray powder in it. "This is what's left of his tonk. We thought you'd want to be the one to keep it."

He took the envelope in a hand which required a suprising amount of energy for him to lift; and tucked the drug away into a chest pocket of his shipsuit.

"You had to tie him up?" Giles asked. "But how is he now?"

"Quiet," she said. "Too quiet. We have to watch him all the time. He's tried to kill himself several times. They go into that sort of depression after the pains quit, during withdrawal, Biset says. She's seen other cases of addicts arrested by the police and having to quit cold, like this. The depression can last for weeks. She also said we'd all be better off if he killed himself."

Giles shook his head, feebly.

"Poor lad," he said.

"He's not a 'lad' and he's not 'poor'!" said Mara sharply. "He's a very unhappy, maybe psychotic, full-grown man, who indulged himself in drugs and nearly got us all killed."

He stared up at her, puzzled.

"I had the wrong choice of

words, I guess," he said. "But I don't understand—"

"No," she said. "That's your trouble. You *don't* understand!"

She turned and went off. He had an impulse to rise from the cot and follow her, to make her explain herself. But the first attempt to sit up made his head swim. He lay back, furious at his own helplessness, but helpless nonetheless.

He fell asleep. Later, he woke when it was evidently during a sleep period for the rest of them. The recorder was turned down to a murmur and there was no noise of human voices talking in the background. He felt much more clear-headed and comfortable.

He looked around himself. He was alone in the rear section of the lifeboat. It was as it had been. Even the broken handle to the press was welded back into place. Only, Di and Frenco were not to be seen—they must have moved into one of the other sections. The thought that they might have moved out of consideration for him was oddly touching. Curious. Before he had left Earth on this mission, he would have simply taken it for granted that any arbites would move elsewhere to give him space to himself.

Paul Oca had been right—he had not understood arbites at all. At least, he had not understood them anywhere near as well as he understood them now, after living with a handful of them in these close quarters for fifteen days. On the other hand, Mara had just finished telling him he didn't understand—and no doubt, he grinned wryly in the emptiness of the rear section of the lifeboat, that was true also.

But all such matters of understanding were beside the point. He had probably been a fool to risk his mission and his life by trying to save Esteven from the Captain. But at least he knew enough about himself now to realize that he was self-condemned to such foolishness in certain area of behavior. It was strange . . . Mara had objected to his calling Esteven a lad. He had used the word unthinkingly as any Adelborn might use it in such a situation. But of course Mara was right. Esteven was not a lad; although it was part of Adelborn attitude to think of the arbites as simpler, child-like individuals, limited by birth and training.

Curiously, at the moment, he found himself wondering if exactly the opposite was not true. The arbites aboard here were anything but simple, non-mature people. In fact, with the possible exception of Di and Hem—and possibly not even them, come to think of it—they were not merely adults, but hardened adults, scarred and twisted by the lives they had led, to the point of having or lacking the character traits that they showed.

He, on the other hand . . . perhaps he was the immature specimen. Life had not operated upon him to make him what he was.

What he was in character and reactions had been a suit of armor ready-made and waiting for him to put it on at so young an age that he had no real judgment about its worth. Since then, he had worn it unthinkingly. It was not until this trip off-Earth, with its mission, its burning spaceship, its lifeboat and its handful of shipwrecked arbites, that he had begun to feel differently about many things, and change inside his armor. What he had felt and the changes he had experienced had left him adrift for the first time, at a loss to understand the rights and wrongs of matters he had always taken for granted.

He felt lost, now, and weak. There was a strange unhappiness in him he could not identify. As if he was lacking in something . . . something necessary. For a second he entertained the thought that it might be a simple physical thing he was feeling, the natural aftermath of the concussion from the blow on the head. But that seemed hardly likely . . .

He shoved that whole question aside. There was something more important to think about. If he had been out of matters for as long as five days, it was only a matter of hours now until the lifeboat would pass the point where changing course from Belben to make an earlier arrival at 20B-40 would be possible. They had reached the point where the Captain must make the change—without any more delay; and, for the first time, Giles felt he had found a way of convincing her to do it.

Now was an ideal time to talk to the Captain, with all the others asleep. A trifle gingerly, half expecting any sudden movement to wake the swimming head he had felt earlier when he tried to sit up, Giles lifted himself first to a sitting position on the edge of the bed, then slowly got to his feet. But his head stayed clear. He was conscious of a feeling of delicacy, as if he was made of glass above the shoulders and might shatter if jarred too abruptly, but other than that he felt as good as ever.

He walked slowly and carefully through the pair of screens and up to the front of the ship. As he went, he examined the *ib* vine he passed. The dead leaves were many now; and only an occasional unspotted fruit showed among the mere handful that seemed to be ripening. When he got to the front section where his own cot was, he saw the tank which collected and held the juice from the *ib* fruit. It was now welded against the hull in a new position, just back of the Captain's screen. Only the Albenareth, herself, could have done that. Giles had not even been aware that there were tools aboard capable of removing and rewelding the tank in this new position.

He went around the screen that hid the Captain's control area. The alien, herself, sat as he had seen her last, in the furthest of the two command chairs. Her eyes were closed and she did not move, even

when he came up against the other command chair with his knees and the chair rattled.

"Captain," said Giles, in Albenareth.

There was no response. The long, dark figure did not stir.

"Rayumung," said Giles, *"I must talk with you. We have reached a moment of decision."*

There was still no reaction from the Captain.

"If you do not wish to discuss this matter with me, I will act without discussion," said Giles.

Slowly, the round, dark eyes opened. Slowly, the head swiveled to face him.

"You will not act in any way, Adelman." The buzzing alien voice was as expressionless as ever, but now there was something distant about it, as if the Captain spoke to him from a long way off. *"I am not yet helpless to control what is done on this lifeboat."*

"No," said Giles, *"but each day you give more of your strength to the new life inside you. I believe you are weakening faster than we, who lose strength only because we lack adequate food and drink."*

"No," said the Captain, *"my strength is greater and will remain greater."*

"I will accept that if you say so," said Giles. *"It does not matter. All that matters is that very shortly it will be too late to alter course to 20B-40."*

The dark eyes regarded him without moving for a long moment.

"How do you know this?" the Captain asked.

"I know," said Giles. *"That is all that is important. It is even possible that I could change our course for 20B-40 myself—"*

"No," said the Captain. For the first time Giles thought he heard a faint trace of emotion in the Captain's voice. *"That is a lie you tell me. A foolish lie. You are helpless here in space like all your race."*

"Not all our race," said Giles. *"Some of us know how to guide ships between the stars. But you interrupted me. I was about to say that whether I could change the course for 20B-40 or not, I would not, for I respect such decisions as belonging to the officer in charge of any vessel in space."*

"Then respect the course which takes us now to Belben."

"I can not," said Giles. *"As you have a responsibility to the single life you carry, I have a responsibility to the six other human lives aboard."*

"The lives of slaves," said the Captain, *"are of no value."*

"They are not slaves."

"As I count, they are slaves, and worthless."

"As I count, they are men *and* women. *They must survive. To ensure they survive, I am ready to give the Captain what she wants."*

"You?" the alien gaze did not move from Giles' face. *"You cannot give me back my honor."*

"Yes," said Giles. *"I can. I can*

identify for you the one who destroyed your spaceship. I can deliver that individual into your hands."

"You . . ." The Captain surged up from her seat. *"You know who did it!"*

"Touch me—" said Giles, swiftly, for the long, thin hands were almost at his throat, *"touch me and I give you my promise, which is my contract, that you will never know."*

The Captain dropped back into her chair.

"Tell me," she said. *"For the honor of all those who worked my ship with me, for the honor of that which I carry within me—tell me,* Adelman!"

"I will tell you," said Giles. *"I will place the individual I name in your hands, and your hands alone, to do with as you will—once all the humans aboard here are safely down on 20B-40."*

"You would have me change course from that destination marked out by honor and duty!" said the Captain. *"You would hold back information until I have lost all hope of buying credit of honor for the unborn last of my line, until you are landed among other humans who will protect you, no matter what. You will cheat me, human!"*

The last words came out on a high note that was almost a cry.

"I will name and give you that individual I speak of—free from interference to do with as you will," said Giles steadily. *"That is my promise, my word and my contract. Your people have done business with the Adelborn for some generations, Rayumung Captain. When did an Adelborn ever cheat one of you?"*

"It is true," said the Captain, looking into the front viewscreen before her as if she hoped to find some support and assurance there. *"The word of such as you has always been good, in my knowledge."*

She stopped speaking. Giles waited. There was no sound in the small area behind the screen guarding the control consoles and the command chairs, but the sound of Giles' own breathing. Finally, the Captain stirred.

"I must take you at your word," said the Captain at last, once more speaking in that distant voice in which she had first answered Giles. *"If I did not, and you were honest, I would have compounded the dishonor now upon me and mine, by passing by an opportunity to regain the honor I have lost."*

Giles breathed out, softly. He had not realized that he had been inhaling and exhaling so shallowly—mere cupfuls of air from the upper part of his chest as he waited for the Captain to decide. She turned her head back to look at him now.

"I will make the first course change now, the second course change later," she said. *"The angle is not such that a single change is indicated. After I've made the first change we must stay twelve hours on that course before the second and final correction can be made."*

TO BE CONCLUDED

MAIL SUPREMACY

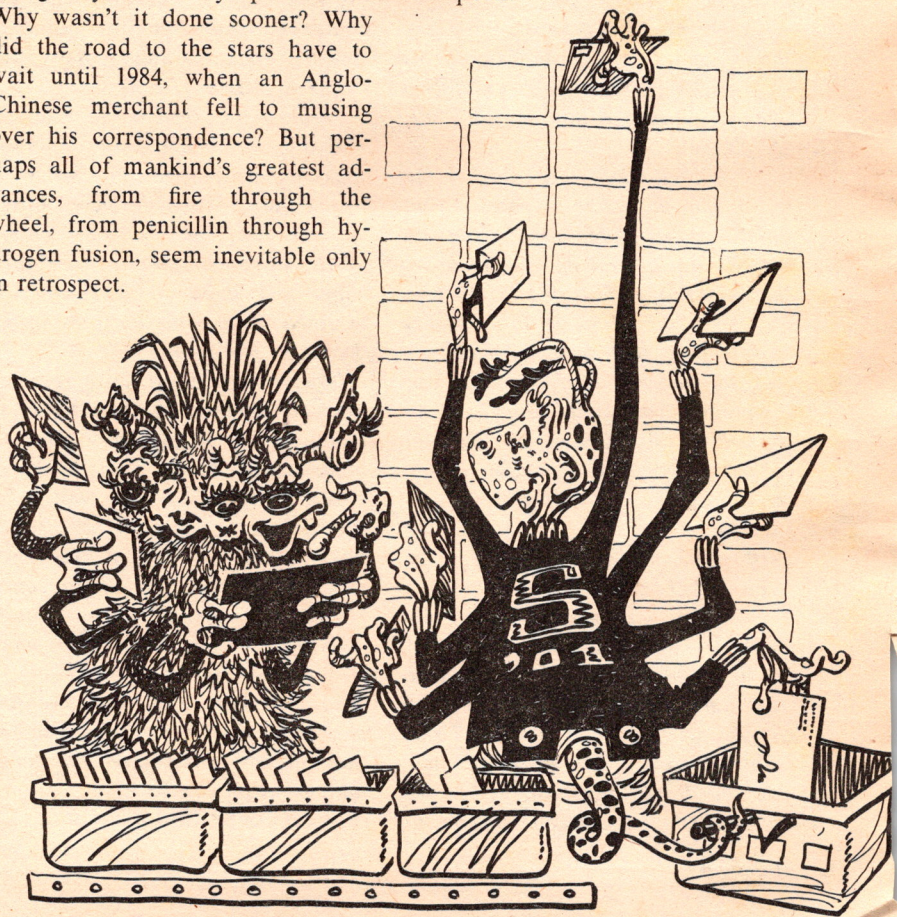
Unsolved problems
always seem very complex,
while their solutions
usually seem quite simple.

HAYFORD PEIRCE

It all seems so inevitable, now that mankind is spreading out through the galaxy. The only question is: Why wasn't it done sooner? Why did the road to the stars have to wait until 1984, when an Anglo-Chinese merchant fell to musing over his correspondence? But perhaps all of mankind's greatest advances, from fire through the wheel, from penicillin through hydrogen fusion, seem inevitable only in retrospect.

Who remembers the faceless thousands who unlocked the secret of nuclear energy, the man who dropped the first atomic bomb? Mankind remembers Einstein.

Who remembers the faceless thousands who built the first moonship, the man who first stepped upon an alien world? Mankind remembers Verne and Ley and Campbell.



KELLY FREAS

As mankind remembers Chap Foey Rider.

Chap Foey Rider's main offices were in New York, not far from Grand Central Station. From them he directed an import-export firm that blanketed the globe. On November 8, 1984, a Friday, his secretary brought him the day's mail. It was 11:34 in the morning.

Chap Foey Rider frowned. Nearly noon, and only now was the mail delivered. How many years had it been since there had been two deliveries a day, morning and afternoon? At least twenty-five. Where was the much-vaunted progress of the age of technology?

He remembered his childhood in London, long before the war, when there had been *three* daily deliveries. When his father would post a letter in the morning, asking an associate to tea, and receive a written reply before tea-time. It was enough to make a bloke shake his head.

Chap Foey Rider shook his head and picked up his mail.

There was a bill of lading from his warehouse in Brooklyn, seven miles away. Mailed eight days ago.

There was a portfolio print-out from his investment counselor in Boston, 188 miles away. Mailed seven days ago.

There was an inquiry from his customs broker in Los Angeles, 2,451 miles away. Mailed four days ago.

There was a price list from a pearl merchant in Papeete, Tahiti, 6,447 miles away. Mailed three days ago.

Chap Foey Rider reached for his slide rule.

He then called his branch manager in Honolulu. He told him to mail a letter to the branch manager in Capetown, 11,535 miles away.

The Capetown manager called Chap Foey Rider two days later to advise him that the letter from Honolulu had arrived. Although still Sunday in New York, it was early Monday morning in Capetown.

Chap Foey Rider pondered. The length of the equator was 24,901.55 miles. No spot on Earth could be farther than 12,450.78 miles from any other.

He reached for the World Almanac.

Bangkok was 12,244 miles from Lima. He smiled. He had offices in each city.

A letter from Bangkok reached Lima in a single day.

Chap Foey Rider returned to his slide rule.

The extrapolation was staggering.

One further test was required to prove his theory. He pursed his lips, then carefully addressed an envelope: *Occupant, 614 Starshine Boulevard, Alpha Centauri IV.* He looked at his watch: good, the post office was open for another hour. He personally pushed the envelope through the Out-of-Town slot and strolled home.

Returning to his office the next morning, he found in his stack of mail the envelope addressed to Alpha Centauri. Frowning, he picked it up. Stamped across the front in purple ink were the words: *Addressee Unknown, Returned to Sender.*

Chap Foey Rider lighted his first cigarette of the day and to conceal his discontent puffed perfect rings toward the ceiling. Was the test actually conclusive? True, the envelope had been returned. But with suspicious speed. He reviewed his chain of logic, then studied the envelope with a magnifying glass. There was, after all, nothing to indicate *which* post office had stamped it.

He ground the cigarette out and reached for a piece of paper. He wrote firmly, without hesitation:

The Rgt. Hon. Chairman
of the Supreme Galactic Council
Sagittarius

Sir: I feel I must draw to your attention certain shortcomings in your General Post Office system. Only yesterday I mailed a letter . . .

Chap Foey Rider awaited the morning's delivery. Eventually it arrived.

There was an envelope-sized piece of thick creamy parchment, folded neatly and held together by a complex red seal. His name appeared on one side, apparently engraved in golden ink.

Expressionless, he broke the seal, unfolded the parchment, and read the contents. It was from the Executive Secretary, Office of the Mandator of the Galactic Confederation:

Dear Sir: In reply to yours of the 14th inst. the Mandator begs me to inform you that as per your speculation the Galactic Confederation does indeed exist as primarily a Postal Union, its purpose being to promote Trade and Commerce between its 27,000 members. Any civilization is invited to join our Confederation, the sole qualification of membership being the independent discovery of our faster-than-light Postal Union. His Excellency is pleased to note that you, on behalf of your fellow Terrans, have at long last fulfilled the necessary conditions, and in consequence, an Ambassador-Plenipotentiary from the Galactic Confederation will be arriving on Terra within the next two days. Please accept, Mr. Rider, on behalf of the Mandator, the expression of his most distinguished sentiments.

". . . to promote Trade and Commerce . . ."

Chap Foey Rider restrained himself from rubbing his hands together in glee. Instead he pushed a buzzer to summon his four sons to conference. The stars were coming to mankind. Rider Factoring, Ltd. would be ready for them; He called the mailroom to tell them to be on the alert for a large package from Sagittarius. ■

the reference library *Lester del Rey*

ALIEN CONTACT

The story of man's meeting or dealing with alien beings and cultures has formed one of the most appealing ideas of science fiction since its beginning as a separate category. Both Edward E. Smith, PhD, and John W. Campbell, Jr., used contact with aliens as the major element in their stories of superscience. The idea of such contact is still with us, and certainly as popular as ever.

During the course of more than forty years, however, the readers have grown much more sophisticated, and the requirements for such a story are much tougher. Early examples used aliens who were basically just other human beings. They might be more benign or more villainous, but their essential nature—and often their form—was human. In somewhat later stories, the form was changed; but their nature and their cultures were still essentially human. The idea that function follows form was slow to develop. Even in the Fifties, most aliens were given cultures that were directly derived from some type of human society, often one that was supposed to be planet-wide, though it came from some tiny, isolated human one.

Fortunately, some of today's writers of science fiction have learned to devise better aliens and to place them in cultures that show non-human attitudes and evolutions. Now, instead of simply humans versus the bad guys (or goody-goody guys), we can finally have stories of conflict derived from the logical difficulty of two wildly divergent cultures struggling to adapt to each other, or to make each understood by the other.

One of the most carefully developed and truly different set of aliens in a non-human culture is to be found in *The Mote in God's Eye,* by Larry Niven and Jerry Pournelle (Simon and Schuster, 537 pp., $9.95). It is also a novel which carries more wildly enthusiastic praise from major figures in our field than can be found on the jacket of any book I've seen. Perhaps some of that fulsome praise is justified. (Also an April selection of the SF Book Club, $2.98.)

The story begins more than a thousand years from now, when men have colonized a host of worlds beyond our sun. There have been a number of wars during that time; an empire of the stars has been set up and has been destroyed by such wars; now a second Empire has come into being, and is fighting for its existence. Men have not yet found an alien, intelligent race, however. Then, from an almost inaccessible part of the galaxy, a strange ship appears, with a

single creature who is killed when a human ship contacts it. Two human ships are sent out to investigate the unknown world from which the alien must have come on its 135 years of traveling through space. To get there, the human ships must pass through the atmosphere of a red giant sun, but they have screens against the energy as well as faster-than-light drive.

That takes up the first hundred pages of the book. And alas, most of those pages are devoted to one cliché after another about the human culture. That culture might best be described as one modeled after all the bad romantic and historical adventure stories written around the turn of the century. Man has colonized the stars, built and destroyed a galactic empire; but his development has been in the direction of a worse than static society modeled on the late Nineteenth Century. We have a system of nobles and an established Church, with all nobles and churchmen essentially good guys. There is a strong military structure, modeled on His Majesty's Navy from the novels of World Wars I and II. Military men are strong and brave and ever faithful. And, of course, our hero is both a Lord and a military man, so we know he's the ultimate.

Scientists, as one might expect, are well-meaning; but they are also terribly naive about the need to preserve the empire; they act like silly, trusting fools. The only businessman shown is a coward and a rogue, naturally. Coming from a planet named Levant, he inevitably must despise and hate Jews. As for women, they've been pushed back pretty much into the position men assigned them at the turn of our century. Sally, our heroine—necessary for the hero, you see—is the only one we really see. She's a scientist, which may account for her being silly; but she is particularly subject to purely emotional judgments. Long before the novel ends, I found it impossible to see why our hero should want anything to do with her; indeed, he seemed to be aware that her nonsense would cause him no end of trouble. But I suppose he had no choice, if women in that far-flung culture were all an inferior race.

Anyhow, with a mixed crew of military men and scientists, our hero gets to the world of the aliens. He is also forced to take along the traitorous businessman and the girl; you see, the plot needs them, whatever the logic of their being taken. And contact is then made with the best aliens and most truly alien culture I've yet found in a novel.

The alien Moties are neither physically nor mentally human, and they have a complex culture dictated by certain rigid demands of their own physical heritage, something it would be unfair to reveal ahead of time, but quite convincing. And they turn out to be a race that is fractionated into types, according to their work; in this, they are like an insect colony, though the similarity as worked out is not applicable to their culture. There are Masters, Engineers, and various others. There are types bred for communication between

types—and this is one of the more clever touches of the novel; these Mediators are the ones contacted by humans, and they can not only master the language, but can also empathize with humans and even seem to think like humans. This makes it possible for the reader to follow the aliens without making them facsimiles of humans.

There are also sub-alien creatures called mini-Moties, which are not intelligent but which instinctively know how to build or improve almost any kind of technical machine or gadget.

The humans are supposedly shown everything about the culture of the Moties. They find that the Moties know how to build faster-than-light drives, but cannot get out of their system because the only ftl nexus point is within the atmosphere of a star, and they have no screen to protect them. The military men are determined that the Moties won't get this secret, but the girl and the scientists fall completely for the charms of the aliens.

Sally, at this point, proves her real scientific genius. She's a trained anthropologist, all agog over examining an alien culture; she's also just come from long months in a brutal concentration camp, where she proved tough enough to survive. But when an alien begins asking her about how humans might prevent having babies, "her distaste was impossible to disguise." She finally admits, however, "Of course, there are pills . . . but a *proper* woman doesn't use them." Oh, well, what can you expect of a woman scientist?

Anyhow, the humans find their ship suddenly endangered in a first-class emergency, where the novel shows just how good alien contact stories can be. In the end, they decide to go back to their own world. However, there are three sailors stranded on the Motie planet—apparently to show us details about the Moties that the authors couldn't conveniently demonstrate otherwise. They find a real museum of the Moties, meant to preserve technology through an inevitable collapse of the Motie culture. That's a little hard to swallow; why any race possessed of the mini-Moties needs a museum to preserve technology is more than I can see. After all, the mini-Moties don't need training and education; their knowledge is instinctive; they could reconstruct any needed devices without using repositories of previous gadgets. But the museum is there, presumably to teach the readers about the Moties.

Anyhow, the humans return to their world and have to figure out for themselves everything that was shown to the stranded sailors; so we get the idea twice. They also return to find that they are going to have to deal with the Moties forever after—both races are aggressive, and a solution must be found for all.

But of course, before we get the solution, we have to go through a bunch of military trivia, protocol, social trivia, imperial politics, and more protocol. Not to mention the hero's engagement to his fatuous heroine and the nit-picking of the

scientists, who finally decide that aggressive aliens may just possibly be dangerous. When we finally find the solution, however, it's about all that it should be.

Despite its faults, this novel has some marvelous material buried in it, and it will surely be one of the two major contenders for the Hugo and Nebula awards.

Read it, by all means. But first, park your critical judgment somewhere out of your reach, before you crack open the book!

In a less obvious way, *The Eden Cycle,* by Raymond Z. Gallun, (Ballantine Books, 232 pp., $1.25), also deals with human-alien contact. But here, while we do meet the aliens, the emphasis is wholly on the effect upon humanity.

Ray Gallun is one of the old masters of science fiction. He began writing forty-five years ago and continued as a highly popular writer through the Golden Age. His "Old Faithful" was one of the landmark stories that helped to create what became modern science fiction, dealing properly more with human emotions and reactions than with mere gadgetry.

Happily, he hasn't lost his ability through all the long years when he has been mostly inactive.

The basic assumption here is that aliens have contacted us to give us the benefit of their science in creating the only paradise on Earth which seems possible. They are totally, completely and absolutely benevolent. And the future they offer us—if we should care to accept it—is one that can satisfy any craving that any human may have.

Their answer for us is eternity for each individual, with all wants satisfied by surrogate experience—dreams, if you will, but dreams so arranged that there is total sensory experience, with the ability to choose to end any sequence and begin any other at will. They have also arranged a similar fate, obviously, for other races throughout the Galaxy.

Dream-sequence futures, of course, are old stuff in science fiction. But Gallun has carried this far beyond anything that has ever been done before. He begins quietly in what seems to be the rural childhood of Joe and Jenny—and then takes off, once they discover that they are free to experience whatever they will. There is literally no limit to the possibility of completely detailed experience—from the past to the plausible future, from grim reality to the purest flights into fantasy worlds.

The basic question of the novel is how much of that the human mind can take—and what to do when boredom sets in, as it must in time. There's an easy solution, of course—simply have all memory erased and start over.

But suppose that isn't wanted? Suppose you want to have real children who will endure? No problem—that's all provided without ever leaving the dream sequences. Or suppose you want to try reality? There is literally no end to benevolence, which includes full provision for free will.

It seems hard to imagine how any suspense can be built into that

premise. Yet there is a continuous, developing story here as Gallun explores every implication of the situation he has set up. There are real characters, and real problems that demand real solutions. And there are the aliens, whom the human characters can meet, if not really understand.

This is a fine example of taking an old idea and examining its potential until it becomes fresh and important again. I found the novel fascinating throughout.

—

Once in a while, we can have aliens who really are humans, and yet where the difficulty of contact and understanding are as real as in any story of far-off worlds. Cultures can be so alien that the human shape and heredity of the members of a society are of little importance.

A fine example of this is found in Wilson Tucker's *Ice and Iron* (Doubleday, 181 pp., $4.95). Tucker has assumed that in a world about like ours, an ice-age suddenly descends, sending glaciers down into the northern United States. (All right, it couldn't happen that fast; but a writer is entitled to one assumption, and the rest of the story is meticulously logical within the frame of this assumption.) Men are studying the advance of this ice sheet, when they begin to find strange artifacts that could not possibly have appeared where they are found. Most of them seem to be from primitive societies—but none could have come from the past.

In a sense, this is one of the books based on the works of Charles Fort. But Tucker does not belabor that point. And in time, his hero begins to suspect that somehow the artifacts must come from a future when the ice was beginning to retreat!

Then they discover a man among the artifacts—one who is not yet dead.

The book is laid out in alternate chapters, with the ones headed "Ice" laid in the near-present world; the "Iron" chapters are tantalizing glimpses of a time when the ice is melting and a somewhat technological people are driving up from the south and coming into conflict with the semi-savages who have somehow survived through the long freeze.

The contrast between the cultures is built up slowly, and we gradually begin to learn about the strange culture of the "Iron" period, even as the observers in the "Ice" chapters begin to learn hints of what the future is like and why the bodies and artifacts are sent into the past.

There is no real ending to the novel, unfortunately. And yet somehow, Tucker almost succeeds without one. I have a strong prejudice against novels that don't end, but I was only mildly annoyed this time. And I understand that Tucker has agreed to rewrite the projected soft-cover version so that it will have a satisfactory sense of resolution.

The book is excellently written, and its development is smooth and completely interesting. With a somewhat better resolution, it should be top-flight science fiction.

BRASS TACKS

We've received a number of letters about the passing of P. Schuyler Miller. The two which follow seem most representative of our readers' sentiments: he will be missed.

Dear Mr. Bova:

The fortune of working with a man like Julius Schwartz, one-time agent to every science fiction writer living (it seems), only has its drawbacks when he bears news such as that he told me today: the death of P. Schuyler Miller.

I think I grew up on two things: comic books and The Reference Library. For years I scanned Miller's column for the Hugo nominees, and went back over old issues to find his review of a novel I was considering. No reviewer, not even Knight or Aldiss, could treat a book as sharply, kindly, fairly. I seldom disagreed with his perspectives even after I went to Berkeley and became a hot-eyed revolutionary radical . . .

He was the best thing about Analog.

GUY LILLIAN III
2065 First Ave., #13F
New York, New York 10029

Dear Ben:

A postcard from Sprague de Camp informed me that P. Schuyler Miller died October 13.

I never really knew Miller all that well; I'd met him a couple of times at conventions and exchanged a few letters. But he *seemed* like a friend, and I'll miss him. I'll also miss his book reviews. Miller was the one reviewer whose likes coincided with mine often enough for me to use his reviews as buying guides. The Reference Library was always the first section of Analog that I read . . .

ROBERT COULSON

Dear Mr. Bova:

I refer to a letter in your August, 1974 issue by Mr. Harold Heckart, which states that your magazine has finally sunk to the bottom of the barrel along with all other fiction magazines:

The statement is simply not true. I feel that Mr. Heckart still believes that science fiction is the same as it was thirty or forty years ago. I feel that he has failed to see, like so many people, that science fiction is continually evolving, and that it is this evolution which attracts a growing number of readers, and which has begun to bring science fiction into the realm of "literary acceptability."

Does he not realize that for a story to have any intrinsic value it must be about *people,* and not about blasters, and time machines, and who-knows-what other gimmicks that can be imagined? Does he not realize that to be entertaining a story—any story—must con-

vince the readers that the characters could be real, and that what is being described *could* happen? The science fiction that he wants to read died many years ago, but not sadly, because it led up to, and gave way to, writers like Robert Heinlein, who, for the first time, brought *people* into science fiction.

But science fiction hasn't stopped at Robert Heinlein. It will not stop for many years yet.

It is true, in my opinion, that the stories now appearing in Analog are not as good as some. But Analog is not a trash magazine because of that. The main thing which distinguishes Analog from all other SF magazines on the market is honesty, and integrity. Your magazine, Mr. Bova, is not only a company trying to stay in business, it is a magazine trying to help the healthy evolution of science fiction as well . . .

JOHN S. BARKER
49 Rossburn Drive Etobicoke,
Ontario, Canada M9C2P9

Thanks. I hope we also entertain the readers!

Dear Mr. Bova:

Having watched the warfare that you started with your June 1974 editorial on the teaching of science fiction (and continued with the guest editorial by James Gunn in the November 1974 issue), I decided that it was time a front-line warrior spoke up.

I teach three classes of science fiction in high school, as part of an elective English program. Immediately, since you are so caught up in the "qualifications" game, you will probably ask, "What are her qualifications?" Well, I am the happy possessor of a brand new undergraduate English degree. I have as a background sixteen years of reading science fiction, one year of *very* intensive, in-depth research on science fiction, and a deep and abiding love for my work. My job is to teach ENGLISH, using science fiction as a vehicle. How are things going? To borrow "Tony the Tiger's" jargon, GRRRRRRRRRRRREAT!

My bright senior class loves science fiction; my average mixed junior-senior class loves it; my slow junior-senior class loves it. Right now you're going to say, "Oh, come on, Sister, you're pulling my leg—or is that *limb?*" Oh, sure, the kids moan and groan because of all the reading they have to do, but then again, what TV-oriented teenager does not groan when they have to read?

It is a joy to teach an English

THE ANALYTICAL LABORATORY DECEMBER, 1974

Place	Title	Author	Points
1.	Nix Olympica	*William Walling*	1.76
2.	The Indian Giver (Pt. 2)	*Alfred Bester*	2.20
3.	The Weather on Mars	*Alex and Phyllis Eisenstein*	2.90
4.	Encounter Below Tharsis	*Bob Buckley*	3.18

class in which my students come bounding in, fresh from having read a new story the night before, anxious and excited to express their opinions of it. And with their short stories, they get good solid jolts of English . . .

. . . The course is a pilot course for our school, so I've had to construct my own syllabus. I chose my own textbook, which the school purchased. I chose one, repeat one, paperback novel. I figure that if I'm going to do something, it's going to be done well. I do not believe that quantity of material covered will ever make up for the quality of material selected. And I can teach the elements of a short story using a science fiction short story as well as if I used a Nathaniel Hawthorne story.

It breaks my heart to read those plaintive laments in your Brass Tacks column from the science fiction teachers who don't know which end is up. Please, Mr. Bova, I'm no Science Fiction Research Associate, nor am I a member of SFWA, but I am an English teacher. This is only my second year of teaching high school, my fifth year of teaching experience, but I remember too vividly what it was like, struggling to get my feet on the ground. Should any science fiction teacher write to you in the future, requesting help of any kind, if you wish to direct them to me, please feel free to do so.

I'm no Thomas Clareson, but I *can* send them a copy of my syllabus, and photocopy the notes I've made on science fiction history. To a new or struggling teacher, every little bit helps . . .

SISTER JUDE ANNE STATUTI
Abp. Kennedy High School
Conshohocken, Pa. 19428
God bless you!

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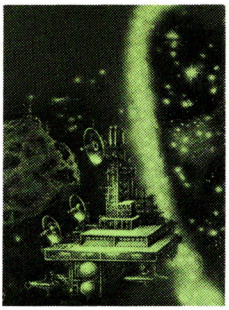

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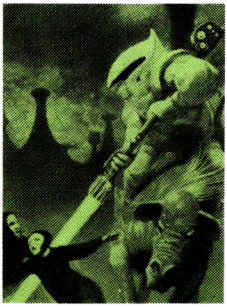

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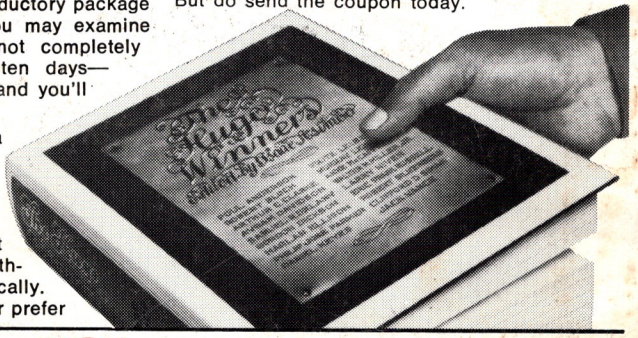

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